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In This Issue:
- ☑ Vacuum Brake - Auto Steam Cut-off Valve
- ☑ Model Photography - Exposing the Film
- ☑ Speed Control for Electric Vessels

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The Cover

Raven — ***A model of a Lake Windemere (UK) cargo vessel by Brian Lemon. The prototype was built in 1871 and is still going strong! Raven is the second oldest steam vessel with its original engine. Maybe you could take photos like this...*** ***turn to page 9***

Australian Model Engineering

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Comment

Always something to do!

I was very pleased to see mentioned in Comment that model engineering gives seniors something to do. Since retirement nine years ago I haven't had time to scratch myself, being absorbed as an active modeller and active member at working bees — these activities occupying five days out of seven!

Just before I finished work I thought I would be smart and bought $250 worth of fishing gear and some $180 worth of art gear to make sure I had the stuff to follow two other interests of mine, low and behold I haven't had time to attend to that side of things yet, what with attending to my model engineering interests.

May I suggest to intending model engineers: don't hesitate if you want to get started, seek out your nearest model club — you don't have to be a tradesperson as there are great modellers from all walks of life. On a working bee day (not an operating day) have a yarn to a few of the chaps about your interest, it doesn't matter whether its model ships, stationary engines, locomotives, modeling a car, or your wife's gas stove (don't laugh these models are about). There is a bewdy model of a saw mill in a folk museum at Busselton in WA and it works! It was built by a chap with little experience and few tools! There is sure to be someone who will put you in the right direction. At an early stage make contact with the President and Secretary of the club, they will be able to advise you about membership and requirements of becoming a member and what is involved, most societies will accept junior members and associate membership, giving you the chance to see if it is what you expected.

Don't get discouraged because you think you haven't the time, remember that a lot of those bewdy 5" gauge models about were built by chaps burning "the midnight oil" because at the time they built these models they were possibly establishing a home, rearing children — besides their employment! This is part of the perseverence process that model engineering teaches you, believe me it's not patience because I have nearly thrown the towel in a few times (run out of patience) but, because I've wanted something bad enough, I've picked it up again later after a calming down period. Then overcame the problem and completed the project with much pleasure and satisfaction the result.

Now pick up your AME your file, your micrometer, your plans, and step in the model engineering direction and you will be in the "Promised Land"!

Kevin Bruderlin

This is an open invitation, during 1996, for all model engineers to tell us how you find "Model Engineering — an Enjoyable Hobby". We need some more — send in your thoughts now!

To our new reader

If this is your first issue of Australian Model Engineering, welcome!

We hope you'll look forward to the ideas, news and camaraderie in each bi-monthly issue.

One of the great things about our hobby is the way model engineers actively help each other. Unless you live in an isolated community, you'll soon discover who has valuable experience in your field of interest, or who will help you to make a part that's too big for your workshop machinery. Look in the *Club Roundup* section to find a club that's near to you; pay a visit and you'll usually find model engineers who live not too far away. Then you can experience the great fellowship that makes our hobby special.

This magazine is prepared in the same spirit of "model engineers helping each other". About two dozen people put many hundreds of hours work into each issue — all on a voluntary basis — to help model engineers in Australia and New Zealand keep up to date and stay in touch.

We rely on our readers to write articles for us — for the same (non-existent) rate of pay! If you have ideas or techniques that you feel would be interesting to others, please drop us a line. We'll gladly help with preparation of artwork or editing if that's necessary. Most important of all, please support the people who advertise in our magazine. Without them to pay the bills, you wouldn't be reading this!

Brian Carter

Model Photography

The Finer Points of Exposing the Film

by Dave Harper

Photos by Brian Lemon

Those you-beaut auto-everything cameras aren't for me. Give me a 35mm single lens reflex (SLR) camera any day. A second hand one with just a built in light meter that allows manual override, like a Pentax® K1000. I bought one some time ago for just $200 at a local camera store. Why? It's a superb camera and ideally suited for my purpose. I'm very happy with it.

First we can look at the films to use; then I'll run through the camera controls and how to use them to take good photos.

35mm film comes in a round metal cassette and usually contains enough film for 12, 24 or 36 pictures. I generally use 24-exposure cassettes as they are the most convenient and economical.

Most photography today produces colour prints. That's what all the 1-hour photo shops are geared for, and what most people take snap shots for. Magazines like AME are perfectly happy with colour prints nowadays, which they can produce in colour *or* black-and-white. But if you need black-and-white prints for any reason, getting black-and-white film processed outside the major cities can be a problem. However, there is now a simple solution.

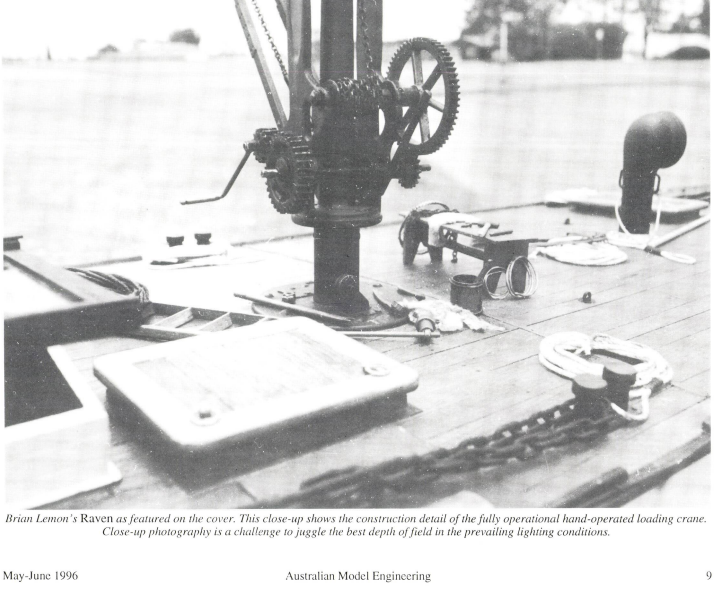
Ilford have produced a film called XP1 which can be processed through the standard Fuji 1-hour process, but which produces black-and-white prints. These are quite acceptable for magazine reproduction. I've used the film successfully and our editor has given my prints his seal of approval! XP1 has another advantage; it is rated at 400ASA.

Speaking of ASA, let's look at film speed.

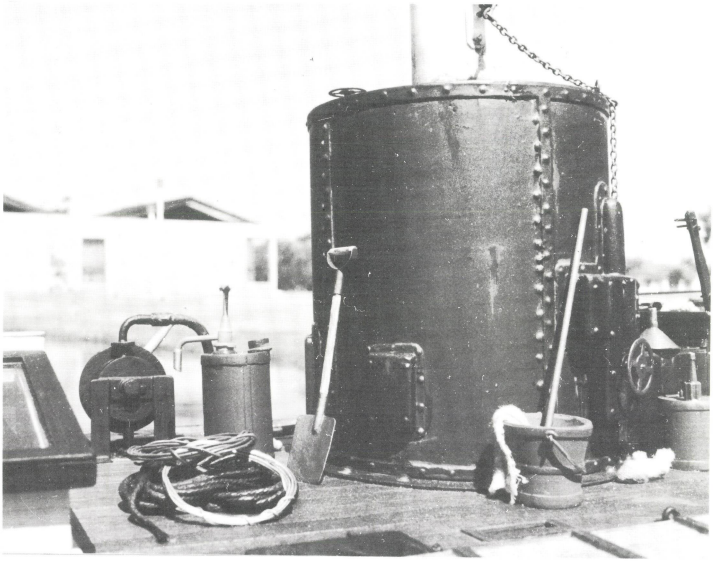
Film speed

The picture you take is recorded on the film by the action of light on the chemical layer on the film, which is known as the emulsion. Naturally, we must use the right amount of light or our pictures will be too dark or too light.

Films are rated by the amount of light it takes to produce a picture on the emulsion. This is called the film speed, and is given a



Brian Lemon's Raven *as featured on the cover. This close-up shows the construction detail of the fully operational hand-operated loading crane. Close-up photography is a challenge to juggle the best depth of field in the prevailing lighting conditions.*



Raven's *boiler (constructed from timber). This view of Brian's attention to detail is about one third larger than the actual model! Having the subject parallel to the film plane, as in this photo, reduces the risk of blurred images due to depth of field constraints.*

number usually followed by the letters ASA. A film with a rating of 100-125ASA is regarded as normal, while a lower number (25ASA, for example) is a slow film. Conversely, films rated at 400-1000ASA are fast films. The normal 100ASA colour print film is fine for everyday snapshots and for photographs for AME.

However, now we have XP1 which is rated at 400ASA, and so rates as a fast film. This is very useful where we want to juggle our exposures for our model photos.

Exposure

The amount of light we allow to fall on the film when we take a picture is known as the exposure. Most film, XP1 included, has only a limited tolerance to variations in the exposure if we expect to obtain a good clear print from it. So, we always aim to use the right exposure for every shot. How do we arrange that? Most cameras nowadays have a built-in light meter to measure the amount of light shining on the subject we aim the camera at.

The reading given by the light meter is usually converted by the camera's mechanism into a setting for the camera which will give the correct exposure under normal circumstances. On all but recent automatics, there is also a control that we have to set to tell the camera what speed film we are using, most important! On a fully automatic camera, that's the end of the story. The settings are used when you press the button.

The only problem is, for our modelling shots, we frequently want to us a setting a bit different from that chosen by the camera. Hence my advice to avoid the fully automatic cameras and choose one like my Pentax® that shows the light setting in the camera viewfinder, in the form of a needle that must be centred to give the correct exposure.

You have to adjust the shutter and aperture controls so that the needle in the viewfinder indicates the correct exposure, or at least, the exposure you want to use.

Shutter and aperture controls

The shutter

The shutter is like a blind that seals off the film from the light coming in through the lens until we press the button to take the picture. When we press the button, the shutter blind opens and closes very quickly, allowing just the right amount of light to fall on the emulsion.

On most SLR cameras the speed with which the shutter opens and closes is adjustable between one second and one thousandth of a second. There is generally a circular knob on top of the camera marked with numbers from 1 to 1000. You turn the knob until the speed you want is opposite the mark on the camera body: all simple and straightforward.

You'll notice that each number on the knob is more or less double the one before it, typically 1, 2, 4, 8, 15, 30, 60, 125, 250, 500 and 1000. These, of course, represent fractions of a second. The 2:1 relationship is important, as we'll see when we look at the next item, the aperture control.

The aperture

The aperture is the hole in the lens that lets the light through. It's controlled by an ingenious device called the iris, which works in much the same way as the iris in our eyes. It opens up in dim light and closes down in bright light, to ensure the right amount of light passes through.

On automatic cameras, the iris does just that: it opens and closes automatically. However, we want to be able to control it ourselves, so we choose a non-automatic camera that is simpler, cheaper and less likely to go wrong!

On our manual camera, the iris is probably controlled by a ring on the lens. By turning the ring one way or another, the iris opens or closes within the limits set by the lens maker. On this ring is a series of numbers that go in a series from about 2, then 2.8, 4, 5.6, 8, 11, 16 and 22. These numbers, known as f-stops, refer to the size of the aperture in the iris. Each step on the ring denotes a 2:1 ratio from its neighbour. For instance, f2 is twice as big an aperture as f2.8, f8 is twice f11, and so on. The usual way we refer to changing the aperture is to "open up to f2"or to "stop down to f22".

Now think back to our shutter speed control — didn't that go in 2:1 steps? Right! Now you can see that by altering the shutter speed one way and the aperture the other, we can keep the exposure constant. To pick an example: if the meter needle in the viewfinder indicates that 1/500 at f8 is the correct exposure, we could move the shutter speed up to 1/1000 and open up the aperture to f5.6 and behold! the exposure is still correct!

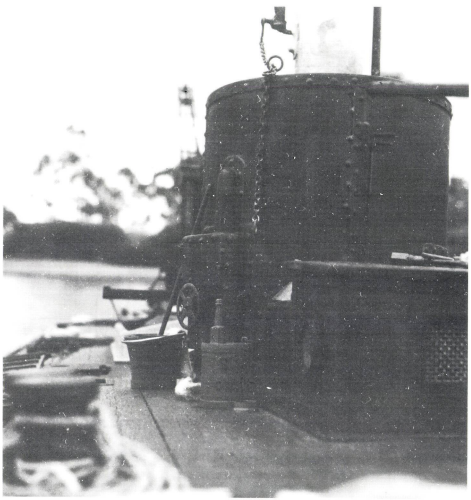
So why bother? Good question! In fact, as far as the film is concerned, it makes no difference at all! However, there are other factors we must consider when we photograph our models. The main ones I'll discuss here are camera shake and depth of field.

How to avoid camera shake

Camera shake is allied to shutter speed. The faster the shutter opens and closes, the less likely that any movement of the camera (or the subject being photographed) will affect the sharpness of the photo.

As an extreme example, if you held the shutter open and swung the camera around, obviously the picture would be just a blur. A common problem is "stabbing" the button as you take the picture. This is guaranteed to move the camera and spoil the picture: the idea is to relax and just squeeze the button gently. Any one who's been trained to fire a gun will remember the admonition, "squeeze the trigger, don't pull it!" The same goes for the shutter button!

Another useful tip is to breathe out just before you press the button. This effectively relaxes you and is much better than holding your breath in as some people seem to do.



A view from the stern of Raven *showing the detail of the engine casing and the reversing lever. This view clearly shows the depth of field limits with the boiler in focus and the foreground and background focussing limits along the deck. In this case the subject is generally on a perpendicular plane to the film plane which makes depth of field more critical.*

Though it's best to use the fastest shutter speed possible to avoid blurry pictures, that's not always possible if we want best depth of field.

Depth of field

One of the more obvious controls on the SLR is the focus ring. As you turn it and look through the viewfinder, the picture becomes sharp and then goes blurred again as you pass the correct focus adjustment.

For distances over about 10 metres this isn't critical with a normal lens. Telephoto lenses are critical at greater distances. However, as the best model photos are taken from very close range — typically, 450 to 900mm — we have to be careful to get the focus spot on.

When you try focusing on something close up you will immediately see that only part of the picture is in focus, and that areas in front of and behind that point get progressively more blurred. The area that is sharply in focus represents the depth of field. It simply means that the lens can only focus on a relatively small range of distance when you get close to the subject. That range of acceptable focus, the depth of field, is affected quite noticeably by the aperture of the iris. Simply stated, the bigger the aperture, the smaller the depth of field — and conversely, the smaller the aperture, the greater the depth of field.

So, to get a decent depth of field for a close-up shot, we need to stop down as far as possible. But of course, as soon as we do this, we have to use a slower shutter speed to keep the exposure correct — then we run into trouble with camera shake! I never said this was going to be easy! Now you will see how the extra speed of XP1 film is so useful, allowing us a couple of extra stops over the standard 100ASA films.

Let's summarize what we've covered in this episode.

Summary

1. Ilford XP1 film is preferred as it gives black-and-white prints and is faster than standard colour film.

2. The f-stop and the shutter speed together control the exposure of the film.

3. To avoid camera shake, squeeze the shutter and use the fastest shutter speed compatible with the depth of field required.

4. Use the smallest practical aperture (largest f-number) to get the maximum depth of field.

Finally, there are many excellent books on photography in your library or bookshop if you want more technical information. There are many camera clubs around that will welcome you if you really get bitten by the "shutter bug"!

This is the third of an occasional series on model photography. The first — an introduction — appeared in AME *issue 42, page 41. The second article — the camera body and lenses — appeared in* AME *issue 54, page 45... ed.*

A Model Sapphire Mining Plant

by Gordon Blake

The working scale model sapphire mining plant on display at the Inverell tourist information centre.

Inverell, a rich sapphire mining centre, is promoted as the Sapphire City. In 1990, the local tourist officer if I could produce a working scale model sapphire mining plant: it would make a good feature display in the new tourist information centre.

After a lot of head-scratching and a good look around at full-size plants and materials, I agreed to proceed. I had built and maintained full-size plants while employed at the Inverell Foundry, so I had a fair idea of what was involved.

Firstly I had to select a scale so that the plant would work in with the available space and be in proportion with some realistic toy models donated for the cause. After looking at available material, ¾" to the foot scale was decided on, mainly because of the size of the tyres on which the trommel was to run.

After eight months, the plant was complete. A neighbour and friend, Trevor Brooks, had built fibre-glassed land-forms for the display. Trevor and I installed the plant ready for the opening ceremony.

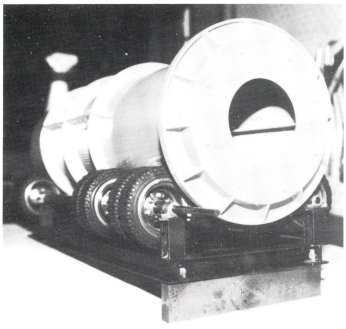
Improvisation

The construction of this model is really a story of improvising. We used:

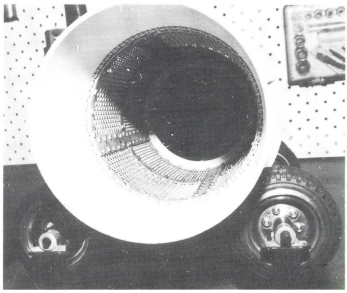
- 100mm (4") black pipe for the trommel.
- Tyres from radio-controlled model cars.
- Universal beams milled from 20mm (¾") and 16mm (⅝") square bar.
- Bundy tube for water pipes and tapering light poles.
- Torches cut down for lights.
- A plastic case (in which a tool was supplied) for a mains box.
- A cigarette display case for corrugated iron for the sheds and dunny.
- Rubber seals from brake cylinders for the tyres on the pulsator — which works — driven by a reject eccentric from my modular traction engine.
- Bearings cut to plumber block shape from solid.
- Allen key and grub screw for universal drive shaft.
- Black H.P. tubing to represent polythene pipe.
- Round garden stake for retaining walls.
- Model aircraft control line for wire rope.
- Globe valve for pulsator water control.

Electric drives

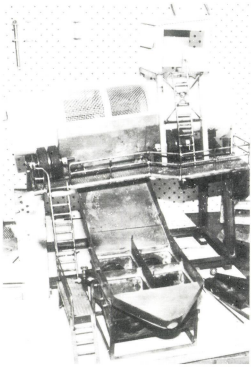
Two 9 volt battery-operated screwdriver motors, wired in series and powered by a battery charger, provided power through appropriate pulley sizes using o-rings for drive belts. The lights were wired in series to deliver the correct voltage to the bulbs.



Tyres from radio-controlled model cars were used to rotate the trommel. Note the hexagonal shafting made from Allen key stock.



A closer view of the trommel innards.

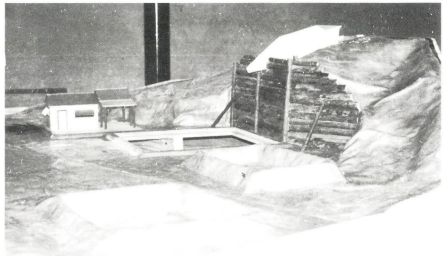


The brass fabrication of the mining plant.

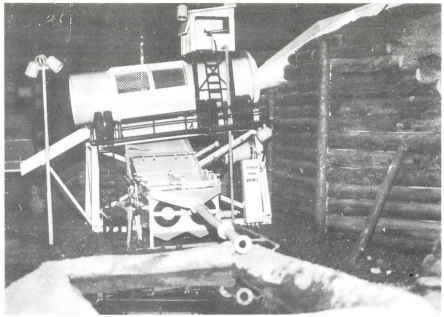
A water pump from an evaporative air conditioner was used to pump water from under the display through the pulsating jigs and return via two settling dams and a creek, all formed in fibre-glass.

Visitors to the centre can see the plant working by pressing a pre-set timer, which runs for about 1½ minutes. This unit has been working for about six years now, and maintenance is minimal. All that's needed is a few drops of oil plus an occasional replacement of an o-ring belt which has perished.

This was a very interesting project. If you wish to see it, come to Inverell — preferably 19 and 20 October for the 8th Australian Miniature Traction Engine Rally!



The raw fibre-glassed land-forms showing the round garden stakes used for the retaining wall and the two settling dams.



A closer view of the completed sapphire mining plant.

4 Drilling and De-burring Boiler Stay Holes

of Peter Dawes

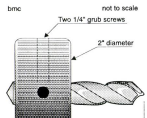
Two special drills make the awkward task of drilling and de-burring boiler stay holes easier. Both are made from the short stubs of drills that have broken off near the shank.

The first is a ¼" drill bit to make a hole in the inner wrapper of a water jacketed boiler such as a Belpaire. This size assumes the stays are ¼" diameter. The outer wrapper holes should be laid out and pre-drilled as normally. The cutting end of the stub should be very short so that when it is inserted through the hole in the outer wrapper, the round shank rather than the cutting part engages in that hole. This prevents the drill reaming out the outer hole and making it oversize.

The second drill, about ⅜" to ½" diameter deburs the holes inside the boiler. It must be shorter than the distance between the two sides of the firebox — so that means it will be about 2" long for a 5" gauge loco.

Sharpen the tip to a 90 to 100 degree point and always keep it sharp to make the deburring job easier.

Make a disc of cast iron or steel about 2" diameter and 1" thick. Chamfer the ends about ⅛". Knurl its rim. Drill it through the centre for a close fit for the drill. Part it off. Drill and tap two holes in the rim (¼" Whitworth or equivalent metric) 90 degrees apart for two grub screws to lock the drill shank in the disc.



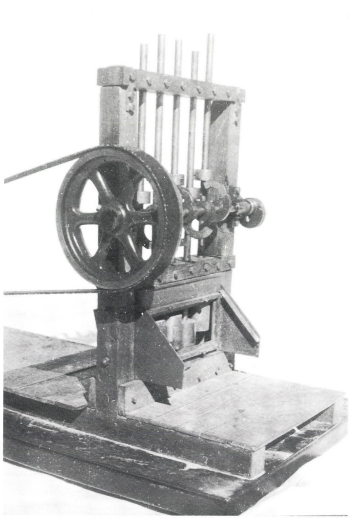
Deburring Tool

To use this tool in the very narrow part of the firebox that fits between the frames, put it inside the boiler and with one hand press it up to the hole to be deburred. This hand stabilises the tool and applies the pressure. Turn it with the other hand.

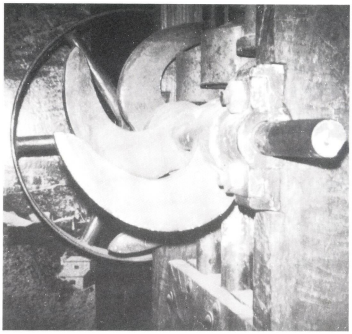
The wide knurled disc gives a good grip to turn it and prevents cuts to the hands that unprotected sharp drill sides can cause. In the deeper, wider parts of the firebox only one hand may be needed, but two still make it easier if you have access.

A Five Head Stamping Battery

Story and photos by Terry Lane



Terry Lane's one inch to the foot scale, five head stamping battery



Lifting cams on a three head unit at the museum, Hill End, NSW.

My modelling career started in about 1980, when I started building a 3½" gauge *Tich*. It soon became apparent that this was no overnight project! Several months of hard toil produced a rolling chassis and partly machined cylinder set — but I was becoming impatient to produce something that would actually run in a reasonably short time. I decided to take a break from the little loco and build something that would not take too long to complete.

After much indecision, I settled on the Stuart Turner No. 10 vertical engine. I bought the castings and, in due course, completed the engine.

Running it on compressed air was great fun for a while, and quite a few evenings were "wasted" just watching the wheels go round! Eventually I tired of this, and got back to work on *Tich*. But by the time I had the loco running on air, I was ready for another break. So I produced a small horizontal boiler à la *Monarch*.

Running the little Stuart on steam rather than air added a new dimension to the activity, and for a while I alternated between short bursts of work on *Tich* and experimenting with all sorts of pumps and fittings for the Stuart. Eventually the steam plant was complete enough for my satisfaction. *Tich* advanced to the steam trials stage: it got no further than this, but that's another story.

Model engineering, like many other diseases, is a progressive illness and it wasn't long before I was looking for something to drive with the Stuart Turner No. 10. After all, there's a limit to the number of revolutions you can watch an unloaded engine run for!

I decided to build a battery.

Why build a battery?

The choice was, perhaps, a natural one. Having spent most of my boyhood and a great deal of my adult life in and around gold country, I was familiar (or so I thought) with these machines. I had spent many happy hours as a child playing on and around the mouldering remains of some of them. I can still recall, after the passage of many years, the fascination of the various mysterious pieces of metal one could collect around these sites. Perhaps that is why I am what I am today. The romance still lingers, in almost any pile of scrap metal!

When I started to research the project seriously, three things became obvious. One, there was very little information on the subject. Two, no two machines that I found were alike. Three, — most disturbing — the damned things shrink! I made several pilgrimages to the machines of my youth, and not one of them was anything like as big as it was thirty-something years ago. Perhaps some day, when I am a little wiser and things have shrunk a great deal more, I will write a learned paper on the subject. But for now I will accept the shrinkage as a natural phenomenon and press on with the matter at hand.

An inspiring book

Faced with a bewildering variation among stamping batteries I was rapidly losing heart. I was even considering abandoning the project, when I chanced to re-discover a fascinating book that had lain dormant in my collection for many years — *Prospecting for Gold* by Ion Idriess. The book gives advice and insight about all aspects of gold prospecting during the early half of this century. More importantly, it devotes several chapters to the erection and operation of stamping batteries.

Idriess provides complete instructions for building a battery largely from bush materials: only the hopper, camshaft assembly, rods, stamps and dies are "bought in". The rest of the structure is literally carved out of the surrounding bush.

This was exactly what I had been looking for, and before long I had drawn up plans for a timber-framed, five-head stamping battery of the type described in the book.

Deciding where to start was a bit of a headache. Idriess' full-sized stamper begins a metre underground with massive buried bed-logs,

hardly a proposition for a model that has to be moved from place to place! In the end I opted to start at ground level and mounted the whole show on a sort of horizontal 'H' frame of 20mm square timber. Construction went on from there, with details of the uprights, hopper, rod guides etc. being worked out as I went along.

It works!

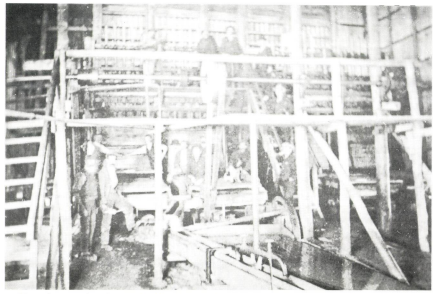
Although the battery was not a long project as such, it took a fair amount of time to get it finished as I am in the habit of having two or three models "on the go" at any given time, and I work on them as the fancy takes me. In the fullness of time, however, the last bolt was tightened up and the battery was ready to run. With stamper and engine mounted on a board and coupled together via a long flat belt, steam was raised in the little horizontal boiler and the steam cock opened. The battery came to life! Everything went well for a period of about five seconds! Then the belt flew off and the battery came to a standstill. The engine, suddenly relieved of its load, achieved a rate of speed undreamed of by Messrs Stuart Turner until I could grab the steam cock handle and silence the high-pitched whine.

I had learnt Lesson Number One: get your belt tracking properly before powering up. It is far easier on the nerves!

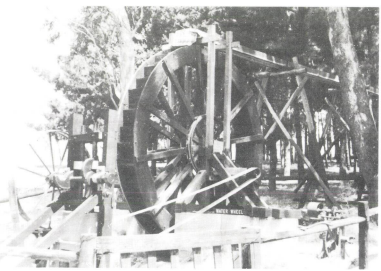
With the belt tracking properly, and a few other minor adjustments made, I tried another run and this time things ran smoothly. Idriess says that 90 beats per minute is about right for normal running but I have found that around 120-150 gives a nice rhythmic effect.

Once the machine was up and running a previously unsuspected feature of these stampers became apparent. The action is not just a simple lift and drop but rather the 'S' cams impart a rotary motion to the rods via the lifters and the stamps drop on to the dies with a twisting action, no doubt assisting in the crushing of the waiting ore. I have run the battery on many occasions since that first session back in 1985. It has been relatively trouble-free ever since. The longest run so far was in 1987 at an exhibition in the local shopping centre, when it clattered merrily away for over eight hours non stop!

The model isn't an accurate scale model of any particular battery; rather it's a representative model of a type common among the battling diggers of sixty or seventy years ago. It was reasonably quick to build, once the design had been arrived at. Coupled to the Stuart, it gives sound and movement to any display and is a real attention-grabber. Indeed, even in 1" scale the noise it generates can not be ignored.



How they used to do it. The "Needs" gold mine automatic battery in West Wyalong, New South Wales. 30 heads and no ear muffs!



A two head battery driven by a water wheel at Karingal Village, Bathurst, New South Wales.

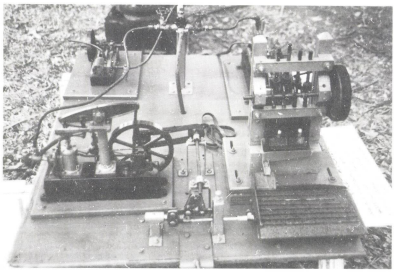
Other batteries

Although at the time of building I had not seen any other models of these machines, some have surfaced since. [see Robert Jones' 4" scale stamper battery in AME issue 65 page 27... bmc] Bill Mitchell, from Goulburn NSW, has a timber framed four-head battery complete with Wifley table driven by a Victoria engine — another of the Stuart Turner stable. The Gold Museum at Ballarat has on display a magnificent model plant, thirty head from memory, with all the gear. Seeing this model is well worth the price of admission to the museum.

Next plans

Although I have other projects under way at the moment, John Snowden's article (AME July 91) has well and truly started the bug biting again, and I am seriously considering putting up another battery — in a larger scale this time, with full detail. John's suggested scale of one quarter would make a most impressive model. It could be driven from a wide range of power sources as, indeed, were the originals.

If there is enough interest, and with our worthy editor's blessing, I would be prepared to serialise the construction of such a model. In this scale it could be a true working model, and I see no reason why small quantities of quartz could not be processed through it. Who knows, we might even strike it rich!



A model ore crushing plant built by Bill Mitchell of Goulburn, New South Wales.

Club Roundup

Budgewoi NSW

Twin Lakes Railway Club has built a 5" gauge track for private running at Budgewoi on the Central Coast of NSW. Two and a half years ago a small number of like-minded people decided that they just wanted to play trains, and after inspecting a number of sites, accepted the offer to build a track on private property at Budgewoi.

The track starts off on a ground-level turntable, proceeds through a shallow cutting, onto an 24.4m wooden trestle bridge and onto an uphill straight, over two bricked culverts on a tight curve and then into the downhill run, through the points and back to the turntable. The entire track is run through light bush after leaving the turntable. The track is now in a running condition, and after the final ballasting is complete, stage two will be commenced.

The Club invites any modellers interested in inspecting the track to contact the secretary, M. Rachow (043) 42 2906 for more information.

Twins Lakes Railway Club
Location: *Yellow Rock* MacLeay Drive Budgewoi
Public Running: Nil

Prospect SA

The improvements never stop at AMSRS Recently completed is brick paving under the new clubhouse verandah and another run-off track from the main turntable in the steaming bay. Beautification is now underway installing more outside seating, painting of infrastructures and the greening of lawn areas with watering systems. The local Council has renewed the club lease for a further 10 years until December 2005.

The Annual Show of work produced a good turn out of members and a diverse range of exhibits. The modern face of the hobby was demonstrated by Allen Wallace with two laptop computers and other equipment. First was the measuring equipment ready for fitting into the Dynamometer Car (being built by two other members) together with a laptop provided with software to give an instant readout of the various functions being measured, all these recorded on the screen. The other computer was demonstrating Allen's valve gear simulation programme which has been around for a while now. (The Valve Gear Simulation Programme is also available from AME, send a 3.5" (1.44M) or 5.25" (1.2M) IBM format disk and a returned stamped address envelopeto AME, PO Box 136, Robertson, NSW, 2577).

Adelaide Miniature Steam Railway Society
Location: 370 Regency Road, Prospect
Public Running: 4th Sunday of every month

New Plymouth NZ

Imagine you are driving your loco... "you drift down the bank from the tunnel, toward the underpass around Castor Oil Corner and up Heartbreak Hill, and if you have done it right you will enjoy it! But if you have done it wrong you won't!" That is how the Club President describes the track which has been operating for some forty years. The last Labour weekend saw the final run on the 2½" gauge portion of the track prior to removal. As well as running every Sunday the NPSMEE members turn out for working bees every Saturday.

A collapsible freight cage constructed of pipe and mesh has been remodelled into a useful passenger handling facility. One end is used as a gate to guide passengers off the platform, the other end and two sides make a folding barrier which replaced the ropes used previously and folds back against the fence when not in use.

New Plymouth Society of Model & Experimental Engineers Inc.
Location: Cnr. Liardet and Gilbert Streets, New Plymouth
Public Running: Every Sunday

Casteldare WA

The Duke of Edinburgh Award Scheme is designed to challenge young people between the ages of 14 and 25 years to personal achievement through a balanced program of practical, physical and cultural activities. One of these is service. The aim of this particular category is to encourage young people to realise their social responsibility as members of the community through voluntary help. Two young women chose to assist on Casteldare Railway's open days as part of their social and community responsibility. They have assisted in many ways including canteen, ticket sales and ticket checking. Great stuff!!

Castledare Miniature Railway
Location: Rear of 100 Fern Road, Wilson
Public Running: 1st Sunday of each month

Auckland NZ

At the club's AGM held last October, Mike Orange was elected President and Steve Berkley returned as Secretary.

Members are re-assessing the appropriateness of the Club Badge and Logo. Prominent in the design is a steamship, more relevant to the closely associated Scale Marine Modellers who have their own design.

Auckland Society of Model Engineers Inc.
Location: Peterson Road Reserve off Waipuna Road, Panmure
Public Running: Every Sunday

Maryborough Qld

MELSA now have a written occupancy agreement with the City Council guaranteeing long term tenancy of the track site in Queens Park. This formalises the verbal arrangement which has existed for the past twenty years and should put an end to any unnecessary speculation.

At the Club's AGM in February, David Proctor (President), Bob Kimber (Secretary) and Clive Bliss (Treasurer) were re-elected.

Besides operating a miniature railway in Queens Park, MELSA is custodian of ex QR B-15 class locomotive No. 299. This locomotive which is retained in working order was the first built by Walkers Engineering for QR and carries Builders No. 1 of 1897. As No. 299's centenary coincides with Maryborough's sesquicentennial celebrations next year, plans for celebration are underway.

Model Engineers and Live Steamers Association, Maryborough inc.
Location: Queens Park, Maryborough
Public Running: Last Sunday of each month

Millswood SA

The past year has seen a resurgence of interest around the boat pond with as many as ten models present on some public days.

Having completed alterations to the 5"g station the work gang have turned their efforts to the 7¼"g station. Alterations and additions to the roof have been completed and a wall to protect drivers, passengers and the waiting public from the weather is next.

The Annual Show of Work attracted

Club Roundup contributions

AME is pleased to receive club newsletters for consideration in this section. Newsletters are often a good source of articles, which we appreciate all the more, but most of all they help us keep in touch.

It is often difficult to decide what to publish and what to leave out. and the task of selecting material for a wider audience takes a lot of time. Also, there is always the risk that AME will publish something that the club considers sensitive. Please help by sending a "press release" page with your newsletter, or highlight the items you think we could use. We'll give first preference to clubs that help us out this way.

bmc

twenty five models of considerable variety. One note of concern was that some wheel profiles and back to back measurements were not correct.

Members enjoyed an outing to Goolwa where they joined the PS Mundoo for a two hour lunch trip up river. (It's a hard life!) The Mundoo is powered by a 16 hp twin cylinder simple/compound engine formerly from the PS Pyap. The wood fired boiler uses a mixture of red gum, box and mallee.

Interclub Run 13 and 14 January 1996.

Saturday was a roaring success with approximately 80 people, 19 steam locos, one petrol, one electric, one traction engine and one steam car in attendance.

The following clubs were represented: Port Augusta, Adelaide Miniature Steam Railway, Penfield, Morphett Vale and of course SASMEE.

By mid morning on Saturday, the 5" mixed gauge had the greatest variety of loco models seen at SASMEE Park Station for many years. The new station passing loop and adjacent sidings were utilized to the maximum.

SASMEE Park 50th Anniversary, 1946 - 1996. To celebrate the occasion, a commemorative exhibition will be held at the park on 2 and 3 November 1996. A bronze medallion is being struck for the occasion. It will be available for a charge of $15 each for non-SASMEE members.

South Australian Society of Model and Experimental Eng, Inc.
Location: off Millswood Crescent, Millswood
Public Running: 1st Sunday and 3rd Saturday

Wanganui NZ

A reflection back on the past year shows that a merging of the two clubs has and continues to work well. The move by the Railway Modellers into the Engineering Society's property has been very smooth and all look forward to a mutually beneficial future. Some future issues to face are the flooding problem, open days, a model railway to build and a possible "Expo" feature.

Wanganui Model Railway and Engineering Society Inc.
Location: 70A Alma Road, Wanganui
Public running: Unknown

Narara NSW

At the Society's AGM the following officers were elected: Graham Bearman (President), Edith Bearman (Secretary), Mick Farrell (Treasurer).

This year's birthday bash at the Central Coast Steam, Model Co-op Ltd in Narara is shaping up as one not to be missed. This is for a number of reasons, namely:

- The new clubhouse should be completed.
- The new 7¼" steam-up bay should be completed.
- The first part of the track expansion (both gauges) through the swamp to triangles at the far end of the society's recently acquired land should be completed.
- The pleasure of entertaining like-minded people, hopefully from across the state.

The date to put in your diary is the weekend of September 7 and 8. There will be open running for the general public on the Saturday, with closed running for bone-fide AALS visitors only on the Sunday. As usual, the society will provide morning/afternoon teas and lunch on both days, plus a BBQ meal on the Saturday night — all on the house, so to speak.

Needless to say, there has been much activity at the society's grounds in recent months. Firstly, and perhaps most importantly, there is the new clubhouse, which will also be available to the local community in an arrangement with Gosford City Council, owners of the land. With a $10,000 grant from the NSW Department of Sports, Recreation and Racing to set the ball rolling, the society embarked on a long-term building project with limited funding Then there was a lucky break — a planned Federal Government-funded training project on the Central Coast fell through and another project was being urgently sought as a replacement. We were in the right place at the right, time with the right contacts. Work started in March and is due for completion on August 22. The two-story building will comprise work and storage bays (yes, locos too) at the ground level and a clubhouse, storeroom, food preparation room and servery and toilets on the first level. There is also a wooden verandah overlooking the track, existing steam-up bay, and station area. Initial plans are to have the building's official opening at the birthday run. The aim of the project under which the clubhouse is being built is to provide training for the long-term unemployed, under trained trainers.

The new steam-up bay near the swamp will cater for the bigger 7¼" gauge locos. A now single and three-phase power supply is available in the area. The swam deviation was planned two years ago when it was indicated by the council that about five acres of land on the city side of the track could be made available. The land was incorporated in the society's development application, subsequently approved by the council. At the time of writing in early April, all concrete pads for the track through the swamp had been laid, also the concrete track-bed to the new parcel of land. Some of the trestles were also complete and this work, along with the decking, should be completed in the next couple of months. The line through the swamp is dual 5" and 7¼" gauge — four track, no common rail - breaking out into two separate cuttings in the new area, Initially, there will be triangles for both gauges at the southern extremity of the land to turn trains. Eventually (over the next three years) the track will be completed right around the new land, following the line of the creek bank, and joining up with the existing track. The track-bed has already been excavated.

Why not come along, with your locos if possible, to our 14th birthday run on September 7/8, see this exciting project for yourself and enjoy our Central Coast hospitality.

Central Coast Steam Model Co-op. Ltd.
Location: Lot 10 Showground Road, Narara
Public Running: 1st Saturday of each month

San Francisco USA

Golden Gate Live Steamers AGM was held in December. John Lisherness was elected President, Jim Dameron remains as Secretary and Art Foss is now Treasurer.

The import of five tons of Welsh steam coal was successful with four tons already distributed.

The Club is in a process of publishing its history and a bid for printing and binding has been accepted. Copies will be available at cost.

Golden Gate Live Steamers inc.
Location: Loma Cantadas and Grizzly Peak Boulevarde, Tilden Park, Berkley, California

Berry NSW

The Berry Railway's 1.6 km long, 7¼ inch gauge track meanders through rolling dairy country about 45 minutes' drive south of Wollongong. There are some challenging, long grades and lovely scenery on Les Boyd's former dairy farm. The AALS-affiliated club has about 25 members. It's known for the warm welcome it gives to visiting model engineers and their friends, but is not open to the public. At the AGM in March, Les Boyd was re-elected President, Iain Harris as Secretary and Bob Henderson as Treasurer. Hugh O'Dempsey was elected Vice-President.

Traction engines run quite often at Berry. The club has decided to extend some paths for them, and hopes to have work finished by the June long weekend, in time for their rail-and-traction invitation run (details and contact in "Coming Events"). Later in the year, the members plan to extend the rails by another 400 metres.

Berry Railway Inc
Tauranga NZ

The first priority of work for 1996 is to complete the second loop line and siding and tunnel handrails.

From Tauranga's newsletter *Wheels & Floats*,

Things really said at committee meetings:

- Not fully conversant — Haven't got a clue.
- Through normal channels — Round in ever decreasing circles.
- Awaiting your instructions — Give us a clue if you have one.

Tauranga Model Marine and Engineering Club
Location: Memorial Park, Tauranga
Public Running: Unknown

Moorabbin Vic

The Silvertops are a regular feature with their Thursday morning runs. Loco lending

and driver training on small gauge engines is producing excellent results.

The next club project is the renovation and painting of the overhead pedestrian bridge.

Steam Locomotive Society of Victoria Inc.

Location: 128 Rowan's Road, Moorabbin

Public Running: 1st Sunday of every month.

Edgeworth NSW

Lake Macquarie's junior member, Bianca Evans, is gearing up to build a 5" gauge *Sweet Pea*.

On the work side, members are designing a new signalling system, making up new all-steel picnic tables, breaking up the old 7¼" concrete platform and repositioning the tracks. New points are planned on the 5" at the station to allow trains from the sidings before the station to gain access to the number two platform. The aim with the new signalling system is that some points will be able to be controlled by either the signaller or train driver. It will feature a track detection system as well as interlocking to prevent points being switched under a train.

Lake Macquarie Live Steam Locomotive Co-op Society Ltd.

Location: Off Velinda Street, Edgeworth

Public Running: Last Sunday every month except December

Mangere (Auckland) NZ

MLS members are delighted to have received an Income Tax exemption from Inland Revenue. New regulations require the Club to display notices explaining the correct procedures in case of fire.

Manukau Live Steamers Inc.

Location: Mangere Centre Park, Robertson Road, Mangere

Public Running: Every Sunday

National Association of Model Engineering Societies (NAMES), NZ

The association was formed on 18 June 1995 in Taupo at a meeting of societies and delegates from throughout New Zealand.

The Executive comprises:

- President: Monty George, New Plymouth.
- Secretary/Treasurer: Les Moore, Tauranga.
- North Island Rep: Gavin McCabe, Lower Hutt.
- South Island Rep: To be elected.

The North and South Island Representative can only be elected by societies from their respective islands.

The constitution and rules will go to the Registrar of Incorporated Societies for registration.

The intention is that NAMES will become *the* voice of the hobby in dealing with NZ government agencies etc., — much the same as AALS in Australia.

Coming Events

16 to 19 May

Hare & Forbes, George St. Parramatta, NSW, 3rd annual sale and model engineering display

See metal and wood turning demonstrations by experienced operators. Rotary club barbeque. Hornsby and District Model Engineers Society members' display of projects. Many great tool and machine bargains!

18, 19 May

Gisborne Vintage Engine Rally and Tractor Pull

Steam Park, Webb Cres, New Gisborne, Vic. Society Secretary, Barry Thomas (054) 28 7047

18, 19 May

NSW AALS Inter-club Run, Wagga Wagga

A great excuse to swap yarns, inhale steam and drive trains in Wagga Wagga's beautiful botanic gardens! Bring your traction engine and you'll be especially welcome — we want to wear in our new traction engine track! Inquiries to David Font. Hon. Sec. on 0412 695 338 (5"and 7¼"g. ground level track.)

8 to 10 June

Hot-Pot Run — Wollongong

You are all invited to a winter run at the Illawarra Live Steamer's track, Virginia St. North Wollongong. Condition of entry: two cans of soup! Contact: Ian Kirby (042) 29 2918 or Warwick Aston: (02) 520 8186. ((2½", 3½" and 5"g. elevated, 5"g ground level track)

8 to 10 June

Berry Invitation Run — Trains and Traction!

A warm welcome to run your traction engine in the scenic grounds, or your 7¼" gauge loco on the 1.6km track, at Berry Railway Inc, 45 minutes south of Wollongong. Char and Fuel provided; ample camping and kitchen/shower facilities at $4 per night. Contact: Les Boyd (044) 64 1304 for more details. (7¼"g track only)

20, 21 July

Guildford Model Engineering Society (UK)

International Model Steam Rally and Exhibition

Our annual Rally and Exhibition for 1996 will be of an International variety. In the past we have had visiting model engineers from most of the western European countries plus others from the USA, Australia, South Africa, Hong Kong and Japan. We are anxious to contact as many overseas visitors as possible to this popular event.

We shall offer hospitality for overseas visitors from Saturday 13 July and the whole week preceding the exhibition. An information pack will be forthcoming for any potential overseas visitors who may like to have details of accommodation around Guildford and details of the weeks programme.

Contact: John Jones. 282 Grange Road, Willow Park, GUILDFORD, Surrey, GU2 6QZ, UK

10, 11 August

Blowfly Rally — Mudgee NSW

Contact: John Oliver (068) 45 2018 ((3½"g and 5"g ground level track)

7, 8 September

14th Birthday run — Narara NSW

The Central Coast Steam Model Co-op Ltd invite everyone to share in their birthday party! Saturday, 11am - 4pm, running for the general public. Saturday evening, free barbeque for AALS visitors. Sunday, private running for AALS affiliated clubs. Morning/Afternoon teas and lunch, bothe days, provided free. Plenty of room for caravans or tents. Contact: Tom Winterbourne (043) 25 4838 for more details. (5"nat 7¼"g. ground level track.)

14 September

Interclub run — Prospect SA

The Adelaide Miniature Steam Railway Society at Regency Rd (off Maud St.) Prospect, welcome local and interstate model engineers to a great day of railway operations. Contact the Secretary, John Wakefield, (08) 362 3269 for further details. (5" gauge ground level track only.)

28, 29 September

Canberra Invitation Run

Come to Canberra for steam and flowers during the Floriade! Contact: Peter Hately (06) 254 7229. (2½" and 3½"g. elevated, 5"and 7¼"g. ground level track.)

5, 6 October

3rd Model Engineering Exhibition

Monash University, Melbourne. Join the fun and spread the word about our great hobby to an appreciative audience at this year's exhibition.

Exhibitors Wanted Contact: Robert Jones (03) 9801 6048.

11, 12, 13 October

Annual Steam Festival — Hornsby Model Engineers

Enjoy a relaxing weekend of steaming in bushland at Galston, just on the north-western edge of Sydney. Large display of members' work plus operational stationary engines. (3½"g and 5"g ground level track)

19,20 October

8th Miniature Traction Engine Rally

Inverell Poineer Village, Inverell, NSW. Contact: Gordon Blake (067) 22 4277.

Steam Chest

with Dave Harper

Hello again steam fans. As promised in last issue I've been going through the stuff I copied from *Burgh's Modern Marine Engineering*. This book, published in 1872, was state-of-the-art then, but now it could well be sub-titled Burgh's Book of Bizarre Boat Engines!

The first set of plates show a set of 300 NHP 3-cylinder engines produced by Messrs. Maudsley Son & Field fitted in the Imperial Russian iron-cased frigate *Pervenelz*. The three horizontal cylinders were 55 inches bore by 30 inches stroke with the cranks at 120°. The cylinders were fully steam-jacketed and worked at 25 psi steam pressure. This explains the massive size for so little nominal HP.

The slide valves had three inlet ports and two exhaust ports and are driven by a separate camshaft which is in turn driven by a train of spur gears from the main shaft. The arm carrying the idler gears can be moved to alter the cut-off and to go into reverse.

There were two surface condensers of the Samuel Hall type, each containing 2,436 18swg copper tubes 6ft 3ins long x ½" inside diameter. The air pumps are operated by brackets fitted to the piston rods. The steam was generated in two boilers each having four furnaces and superheaters.

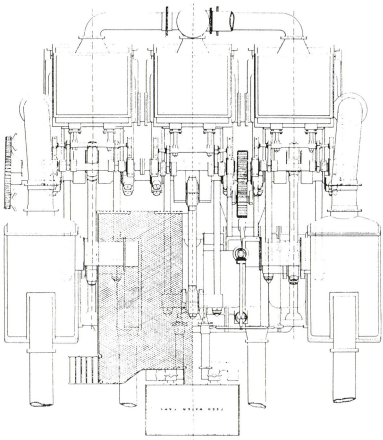
The four-bladed screw was 12ft diameter and 13ft pitch with an increasing pitch on Mr Woodcroft's principle. The vessel was an iron plated battery ship with a ram bow and was built by the Thames Iron Works and Shipbuilding Company. It was of 2,811 tons, builders measurement, was 220ft BP and 53ft beam with a draught of 14ft 6inches.

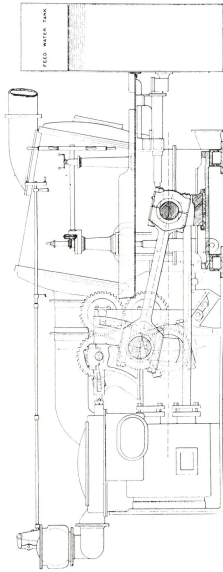
So much for the bare description, but how did it work? It wasn't until I came across the cross-section drawing shown here (figure 79 in the book) that it all started to make sense! This was a double piston rod, reverse connecting rod engine! The cross section shows that the piston rods were at roughly 10 o'clock and 4 o'clock and passed above and below the crankshaft. The crosshead was as shown in the diagram with the slide fitted underneath. From the crosshead the connecting rod went back to the crankshaft.

THREE CYLINDER EXPANSIVE ENGINES 300 HP NOMINAL

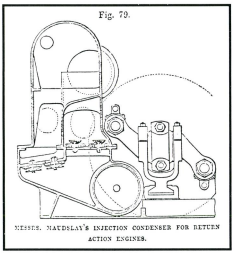
Fitted in the Imperial Russian Iron-cased Frigate "PERVENELZ"

Constructed by MESSRS MAUDSLAY, SONS & FIELD





Above: front view. **Right: enlarged side view.**



The whole idea of this arrangement was to make the engine as narrow as possible in order to fit into the bottom of the hull. Apparently at that time it was Admiralty wisdom that all machinery should be below the waterline for stability and protection from gunfire!

As a result, the extremely short stroke to bore ratio was common, needing huge valves to get the steam in and out, and the twin piston rods required matching twin stuffing boxes. All this on a gargantuan scale by today's standards. When you compare them to windmills, waterwheels and the old beam pumping engines, they don't seem so huge. Even so, the need to work to finer tolerances and to work in the bowels of a ship make the old marine engineers some kinds of heroes in my book! Even the thought of making a working model of one is pretty daunting!

I'll delve more into Burgh next issue, but now back to steam as we know it and some more of Dave Sampson's handiwork.

More from the Sampson Collection

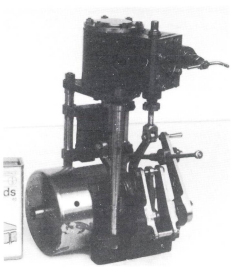
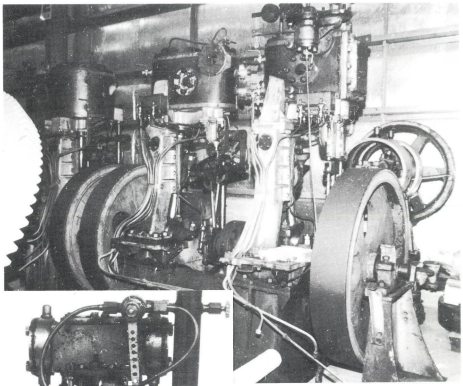


Photo 1.

Photo 1 shows, appropriately, the first model that Dave ever built. It's a single cylinder vertical based on a Stuart 10 cylinder casting of ¾" bore and stroke. The design was worked out at sea and drawn up on the back



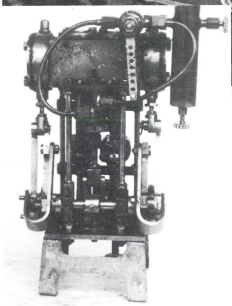


Photo 2.

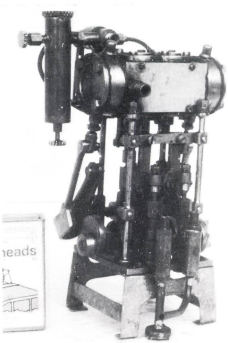


Photo 3.

Photo 4.

of old charts! It has Marshall valve gear, and all Dave says of it is "It worked!"

Photos 2 and 3 show a simple twin with Marshall valve gear with ½" bore and stroke. It was designed and built to go into a 35" LOA tug that Dave still has. The steam powered control and reversing gear was designed to be operated by a single radio control servo. The circular slide valves have rather restricted ports and top speed suffered as a result.

We've recently set up Dave's A-frame engine (shown last issue) at Petrie to work on compressed air. This it does very well, and caused considerable interest. All the "steamies" at Qld Steam & Vintage Machinery Society's Petrie museum were much taken with the originality and workmanship of the engine, particularly as Dave had got the governor working correctly. This prompted me to suggest to Dave that we get together to write about governors, particularly how to make model ones that work. He agreed, and we're working on it!

The Queensland Museum Collection

Recently I was privileged to be let loose in the large warehouse at Coomera on the Gold Coast which is Queensland Museum's storage facility. I had been invited by Chris Lloyd, Assistant Curator of Engineering at the museum, to see all the steam engines that they don't have space to display.

The warehouse is an Aladdin's Cave of machinery, from old cars to aircraft engines, printing presses to pumps, plus a complete hydraulic lift from one of Brisbane's early high-rise buildings! It's a sad fact that most museums can only display a fraction of their collection, and Chris has been heard to mutter

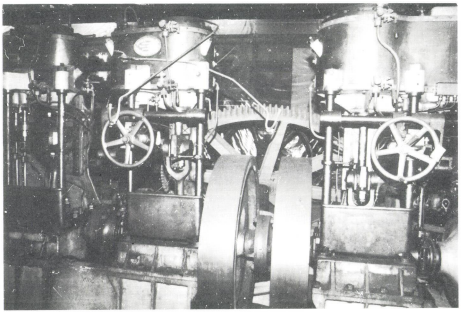


Photo 5.

dark things about Dinosaurs and butterflies getting preference!

I've selected a few oddities from the collection to show you this time, in the hope that our experts out there can shed some light on a couple of mysteries.

Photos 4 and 5 show one of the largest steam engines there, and a real puzzler. It is a Simpson Strickland triple compound engine. This manufacturer is best known for their beautiful Steam Yacht engines, and my first guess was that this was one of them. It's certainly in very good condition, but when I showed the photos around I was smartly told that this was no marine engine, as it had not just one but three flywheels too many! Marine engines have a propeller instead of a flywheel, dummy, I was told. Hmm. The other odd thing about this engine is that the intermediate and low pressure cylinders each have their own Stephenson's link reversing gear. However, when I clambered over the surrounding stuff to look at the HP cylinder, there's no apparent valve control gear at all. All there appears to be is two eccentrics, one driving the slide valve and the other driving what appears to be a Meyer type expansion valve on the back of the slide valve. This is not uncommon on compound and triple expansion engines, but the lack of reversing gear certainly is!

Although on a common base, this engine almost looks like three separate engines hooked together. This has led to the suggestion that it may have been a training engine from a technical college somewhere.

This theory has been supported by the discovery of a similar twin compound engine belonging to QSVMS member Geoff Dunnett. He acquired his engine recently and it is ex Rockhampton Naval Training College.

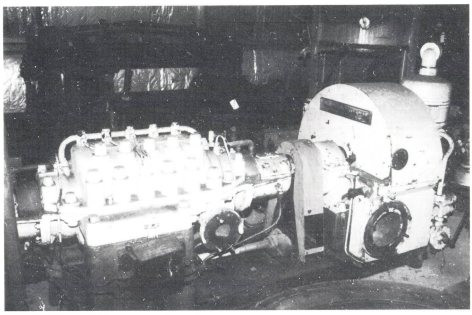


Photo 7.

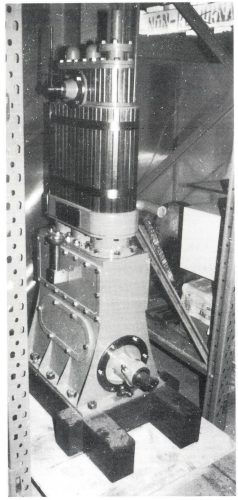


Photo 6.

Geoff's engine also has only the two eccentrics on the HP cylinder and it's own Stephenson's gear on the LP. It also has fittings for attaching a steam indicator to each cylinder and extensions on the valve rods to show the valve positions. I'll show you the photos of it when they've been processed!

Another engine that caught my eye was tucked away between the storage racks. Obviously having been done up for display it is a Willans centre-valve engine and must date from between 1880 and about 1900. These unusual high-speed engines had the steam valves up through the middle of the pistons! They were developed for launches and generating sets, but the mechanical complexities of the design ensured their popularity was short-lived! I have some more information on these engines, and will do a piece on them one day.

Finally, another puzzle. Photo 7 shows a turbine feed pump made by W. H. Allen and Sons, Bedford, UK. The driving end is obviously a steam turbine, but no-one has been able to tell me what kind of pump is hidden inside the massive casing!

I'm hoping that someone among our readers can help solve these mysteries for us. Any letters can be sent via the editor, or I'm happy to chat on the phone most times!

That's all for this time, happy steaming!

Injector Performance Monitoring

by Dick Steele

Photo and drawings for publication supplied by the author

Following many years of part-time construction, building a 5" gauge *Springbok*, the time came to make a suitable steam injector. I liked the use of injectors because of their instant response compared to mechanical eccentric feed pumps which require the locomotive to be in motion. However, I had always been dubious about the reliability of model steam injectors and particularly their fickleness while in operation.

After investigating the design and construction of such an item, and studying D. E. Lawrence's articles 'Making Small Live Steam Injectors' (*Model Engineer* 18 April 1975 - 18 July 1975, since republished), I considered it was possible to produce reliable model injectors.

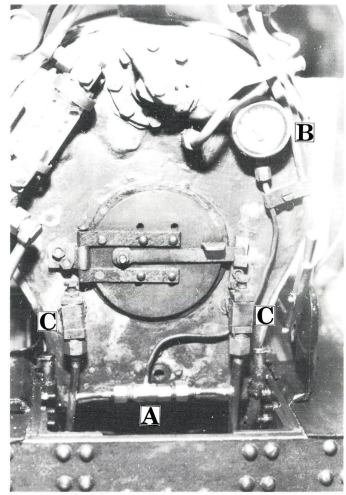
Although my injector bodies are of solid brass, not fabricated as described by D. E. Lawrence, I have followed his cone designs and advice of painstaking. To convince myself that my model injectors were going to be capable and reliable, I tested them on a fellow model engineer's test boiler. The boiler had an adjustable screw and lock nut on the backhead check valve in the delivery line, thus regulating the lift off the ball in the check valve.

My first injectors gave far from ideal results, so I had to make more, with improved quality control.

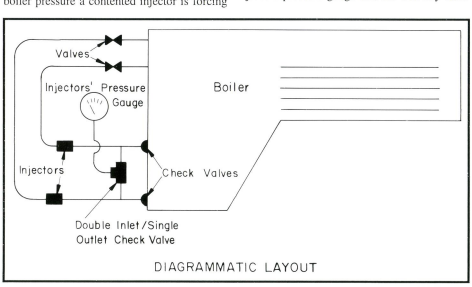
Testing the later injectors was successful, after the necessary adjustment of steam, water and the lift of the ball in the backhead checkvalve.

During these trials, I fitted a pressure gauge in the delivery line from the injector to the boiler to see the pressure at which the water was entering the boiler. Under various conditions the gauge showed instantly how the injector was performing. When the gauge shows a steady pressure marginally above boiler pressure a contented injector is forcing water into the boiler; whereas a fluctuating pressure shows adjustments to water or steam are required to obtain satisfactory results, or that you have a poorly built, nonfunctioning injector. If the pressure gauge shows a steady pressure, but considerably above boiler pressure, it indicates a functioning injector but with a blockage between the injector and boiler (eg. a stuck check valve). For my *Springbok* I have made two injectors. One has an operating pressure range of 100-70 p.s.i. and the other has a 60-30 p.s.i. This arrangement allows much greater flexibility when I need to increase the water level, and yet only one pressure gauge need be used to monitor the pressure of the delivery lines when either injector is used.

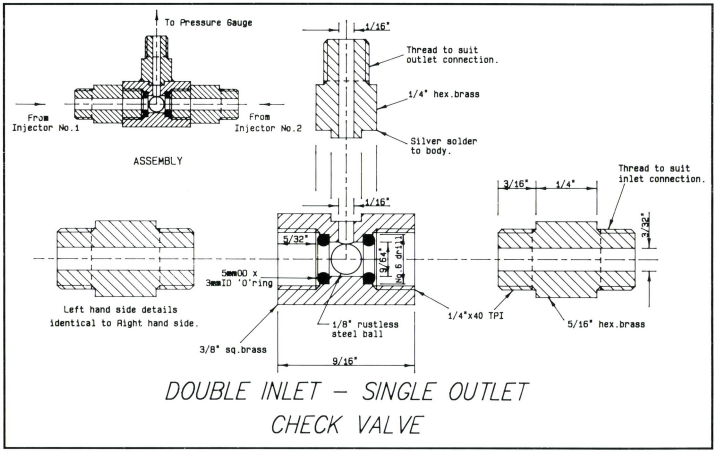
To enable a single pressure gauge to monitor either injector, I evolved the "double inlet/single outlet" check valve, which is fitted between the injectors pressure gauge and the delivery lines from each injector. When either injector is used, the pressure in the delivery line forces the rustless steel ball to seal against the opposing 'O' ring, allowing the pressure gauge to monitor the working injector. When the other injector is used the reverse happens: the rustless steel ball seals against the other 'O' ring. This type of check valve can also be used in other applications where only one exit is required from two separate entries.



The injector performance monitoring setup:
***A)** Double inlet/single outlet check valve.*
***B)** Injector delivery pressure gauge.*
***C)** Injector delivey check valves.*
Part of the cab floor has been removed for clarity.



Preliminary running trials of *Springbok* have proved the convenience of mounting the injector pressure gauge where it is visible in the cabin, me from straining to the side to check the injector overflow. By simply glancing at the pressure gauge I can see how the injector is functioning, allowing me to keep an eye on the track ahead. The gauge has reduced delays and I think it has contributed to safer driving on club running days.



DOUBLE INLET – SINGLE OUTLET CHECK VALVE

Track Gauge and Curve Radii — Versines

and the Development of the 7¼ inch gauge Trackwork at Castledare

by Jack Standbridge

Drawings for publication by Zenon Zalewski

The first laying of track for the 7¼ inch gauge track at Castledare, some 28 years ago, was a trial and error system for our 7¼ inch gauge track.

When Keith Watson completed his 7¼" *Nellie* back in 1962, he and a couple of other interested members made up an 80 foot length of straight track. The metal used for the rails was ⅝" square on 3" x 2" sleepers spaced at 18" centres. Measurements were based on Meadmore's track in Melbourne which was the beginning of Diamond Valley track and, before the war, had been the beginning of Model Dockyard (model railway suppliers). Meadmore used 1" x ½" steel on edge with sleepers at 18 inch centres.

Keith Watson asked me to come along to Castledare and help develop the track, although until then I had been involved only with building O gauge and Gauge 1 tracks. However, all my life I have been interested in and studied railway tracks and their design and I was particularly intrigued with complicated track work (such as the famous multi-track crossing at Newcastle in UK, now long gone).

After constructing much track and turnouts at Castledare, it became evident that the ⅝" rail system was unsatisfactory. It tended to sag between the sleepers, and the method of fixing the rail to gauge by welding 7¼" spacers between the rails was not good enough. Having seen Meadmore's track, I suggested 1" x ½" steel on edge welded to gauge on 12" x 1" x ⅛" strap fixed to 3" x 2" timber sleepers 16" long, spaced at 12" centres. This system has since been modified to sleepers 17" long and 4" x 2" section soaked in old engine oil. Roofing nails were used to secure sets of spaced rail to sleepers. Later we learned that Diamond Valley had gone to a much heavier rail — 14 pounds/yd — but we have stayed with 1" x ½" bar at Castledare (about 5 pounds/yd).

I used a rail gauge based on the Bassett Lowke's gauge which I had used on O gauge construction and the new track has been built using the idea modified for 7¼" gauge. This gauge, shown in Figure 3, is excellent for checking track gauges. It is a simple a 3-point compensating gauge, can be used for any gauge and it will give gauge widening of curved track automatically on a curve of any radius. AALS calls for ⅛" over-gauge on curves — but curves of different radius require different gauge spacing. This gauge unit tool automatically provides the required gauge, and does away with the problems of calculating the correct gauge for different radii.

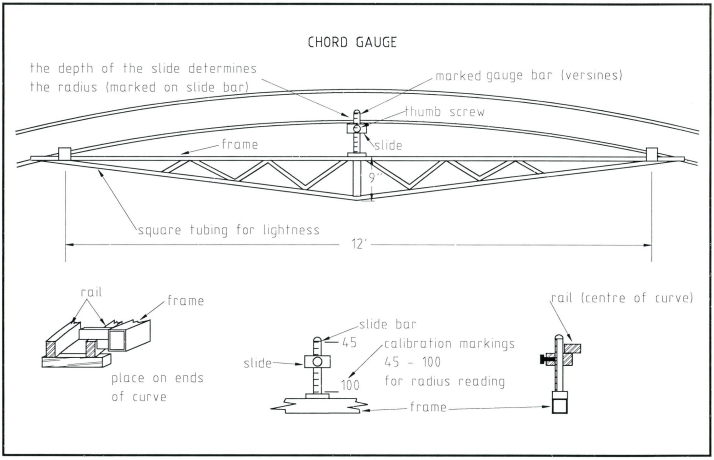


Figure 1 -Three point Chord gauge

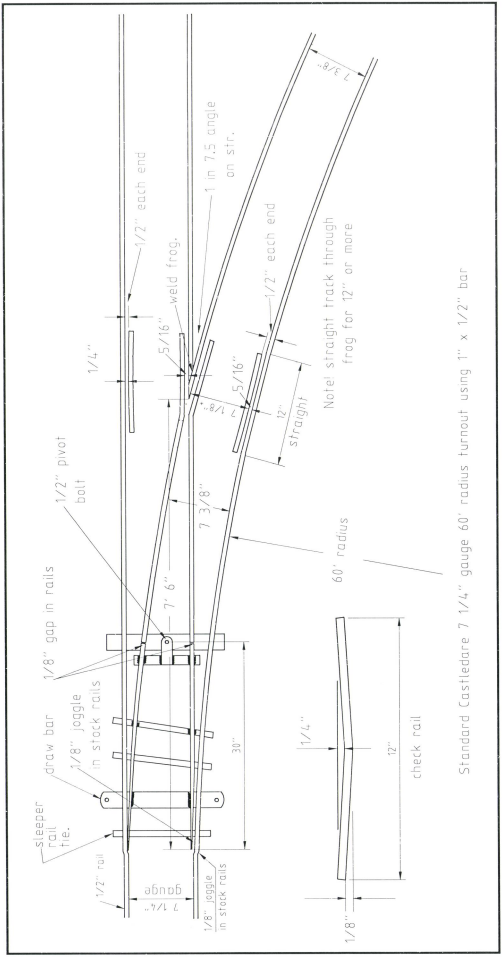


Figure 2 - Standard 60ft Radius Turnout

Making turnouts

There is nothing really hard in making up turnouts (see Figure 2) if the following points are kept in mind.

Draw the turnout first at full size and build the works on top of the plan board, following the clearances to AALS standards. Use the 3-point track gauge to check gauges throughout.

When the first turnout is completed, use it as pattern.

Build others on top of it, by clamping the new turnout's stock rails and closure rails to the profile of the pattern turnout. If an opposite 'hand' is required (RH-LH), place some strap steel on top of the stock and along the rails and tack weld. Then turn over and finish-weld the assembly in place.

To set out a standard turnout set to a curve with a radius of 60 feet, use a line to draw a curve with a radius of 60 feet on to a construction board. Lay out crossings with straight-through frogs and after the first turnout is made, build a jig to these dimensions and lay out. This will simplify accurate construction. Eventually my jig was capable of building 60 foot radius (right hand and left hand), single and double slips and crossings. Any radius can be used, but our adopted standard was 60 feet.

Another jig was made to 'oxy split' 1" x ½" bar on edge, to make up point blades and frogs, while some blades were milled from ⅜" steel.

Except for one short construction period, all turnouts at Castledare have 'joggles' set in the running stock rail to accept the point blades; those that were originally built without a 'joggle' have been or are being converted .

We found this to give the best service, since very fine blades tended to wear away in use, causing operating difficulties and needing more frequent replacement.

The chord gauge

Another gauging tool, the chord gauge, is used to set out a curve while the track is under construction; it can also be used to measure the radius of an existing track, and also to set two prefabricated curves in position at a selected or joint in the track. Figure 1 shows the construction of the chord gauge.

The relationship between the centre of a curve and the chord line which touches the ends of the curve at right angles to the radius is the versine. It is this relationship which is critical in setting out a curve. Table 1 provides the means of laying out a curve of any nominated radius.

To use the Table, find the radius of the proposed curve and note the versine value. This is the distance in inches from the chord line to the outside edge of the

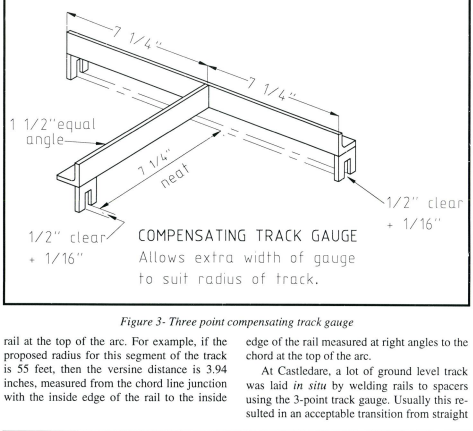


Figure 3- Three point compensating track gauge

rail at the top of the arc. For example, if the proposed radius for this segment of the track is 55 feet, then the versine distance is 3.94 inches, measured from the chord line junction with the inside edge of the rail to the inside edge of the rail measured at right angles to the chord at the top of the arc.

At Castledare, a lot of ground level track was laid *in situ* by welding rails to spacers using the 3-point track gauge. Usually this resulted in an acceptable transition from straight to curve (and vice versa), but does not always apply when prefabricated curves are joined to straight sections.

Table 1 — Versine Distance

Length of Chord — 12 feet	
Radius of curve (feet)	Versine (inches)
30	7.28
35	6.22
40	5.43
45	4.82
50	4.34
55	3.94
60	3.61
65	3.32
70	3.09
75	2.89
80	2.71
85	2.57
90	2.41
95	2.25

A dual gauge track (5 inch and 7¼ inch) is being developed and the turnouts used are a new design for simplicity of construction and maintenance.

PTFE Piston Valve Rings

by Shawki Shlemon

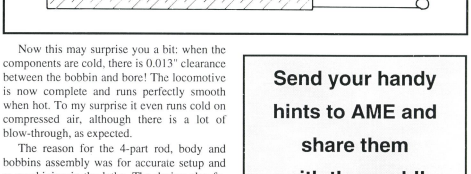
Drawings for publication by Dave Adams

While the use of PTFE (Teflon™) as rings on locomotive piston valve bobbins is not a new subject, I haven't read of using it in any model engineering literature [*see John Wakefield's version in AME issue 65 page 13, and page 48 of this issue... ed*]. I'd like to pass on my experience of making Teflon piston valves for my 5" gauge C38 class locomotive.

The drawing shows the sizes for 1" diameter piston valves. Making them is a fairly simple procedure. The bobbins are machined to nominal 1" diameter (which is the bore of the liner of the valve steam-chest) and are fitted to the machined valve spindle and locked up in position.

The valve assembly and the cylinder chest are put in the oven as separate items and the oven is set at 180°C. After say five minutes, the two pieces are removed and a trial fit is attempted. The diameter of the valves is too great to allow them into the valve-chest bore.

Back to the lathe and skim the bobbins between centres — just a couple of thou. Back to the oven again and repeat the procedure. Do this as many times as necessary until the the valve bobbin is a neat sliding fit in the bore at 180°C.



Now this may surprise you a bit: when the components are cold, there is 0.013" clearance between the bobbin and bore! The locomotive is now complete and runs perfectly smooth when hot. To my surprise it even runs cold on compressed air, although there is a lot of blow-through, as expected.

The reason for the 4-part rod, body and bobbins assembly was for accurate setup and re-machining in the lathe. The design also facilitates adjustment of the valve timing.

Send your handy hints to AME and share them with the world!

A 5" gauge NSWGR 422 class Diesel Outline Locomotive

Part 24 of the construction of a battery electric locomotive

Neil Graham describes the three main prototype colour schemes and puts in place the final touches. Ross Bishop-Wear describes his well proven painting method

Drawings for publication by Brian Carter, loco colourizing templates by Neil Graham. Photos by Neil Graham except where otherwise credited

In this penultimate part of the series, I will describe the main colour schemes as applied to the 422 class locomotives and some of the variations in them. We will also look at applying the cab end numbers boxes also the side and end (where applicable) numbers.

Within this article, some special painting techniques relative to the 422 class are described. For general notes on preparation and painting, there is a boxed description on painting which is an updated version of Ross Bishop-Wear's excellent article which appeared in AME Issue No. 29, February 1990.

422 original

When the 422 class locomotives were outshopped from the Clyde works at Granville in NSW, it was thought that they would carry the same painting format as earlier full cab locomotives of the NSWGR. However, there was some disappointment among enthusiasts that the signal red lining was not to be seen. The original paint scheme was as follows:

- All over with NSWGR Indian Red.
- Yellow lining and whiskers.
- The cab brow and cab window surrounds were yellow.
- Carbody underframe was painted black.
- Inside the horn trumpets was bright red.
- The staff exchanger horn was invariably white.

This colour scheme stayed with most 422s for the first 12 to 13 years. In some repaints and touchups the following "random" variations have been observed:

- The apron and pilot on some were painted black.
- At a later stage a couple of the class had the cow catcher painted silver.
- Sometimes the side of the buffer plates were painted Safety Yellow.
- Sometimes the horns exteriors were painted silver. However, after a short time they degenerated to black.
- Some of the class had the cab steps and bogie steps painted white.

	Paint Schemes				Detail Changes	
	Reverse	Candy	Blue	Other	Buffers off	Xchr sealed
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
42201	x		x		x	
42202	x	x			x	No2 end only
42203	x	x			x	
42204	x	x			x	
42205	x	x	x		x	Both ends
42206	x	x	x		x	Both ends
42207	x		x			
42208		x	x		x	
42209		x	x			
42210		x	x		x	No2 end only
42211		x	x		x	
42212	x		x		x	
42213		x			x	
42214		x	x		x	
42215		x	x			Both ends
42216		x	x		x	
42217	x	x	x			No2 end only
42218		x	x	x	x	Both ends
42219		x	x		x	Both ends
42220				x	x	

Notes:

(i) Three different Reverse Livery schemes have been identified with further variations in logo and numbers size and location.

(ii) Three different Candy schemes have been identified with further variations in logo colour, size and location. Number size and location on the sides also vary.

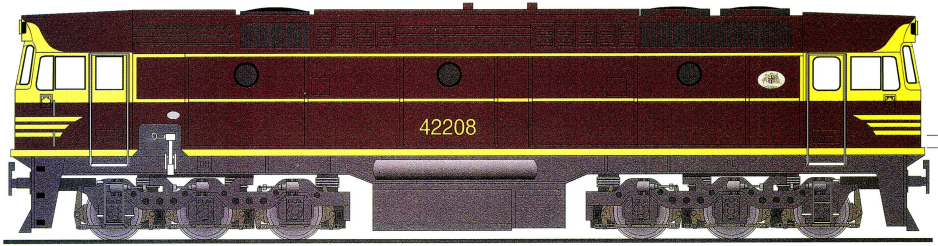
(iii) 42207, the first Freight Rail recipient, received a lighter shade of blue. 42212 was the first to receive the darker shade. It did not receive logos and still does not carry them (as at February 1996).

(iv) 42218 received the Bi-centennial livery. It was re-painted to a variant of the Freight Rail Blue scheme in 1992. 42220 received a modified original livery when it was upgraded to Super Series at the Clyde works in 1979. It still wears this livery (February 1996).

(v) Buffing plates have been progressively removed from the late 1980s onwards. With the transfer of the 422 class to National Rail it is assumed all buffing plates will be removed.

(vi) The No.2 (radiator) end staff exchanger recess was sealed with installation of radio equipment. Some class members had both ends sealed. It is possible other class members are similarly treated.

Table prepared by Ross Verdich



Side numbers 28.6 high x 14.3 wide x 3.7 brushstrokes

COLOURS

Deep Indian Red
Golden Yellow
Black
Bright Red
Silver

SUBSTITUTES

No.448 - BS 381C 1964
Pascol Golden Yellow
Mirotone Mirokey 747 Black #9999
Signal Red
Satin Silver

LOCOMOTIVE COLOUR ALLOCATIONS

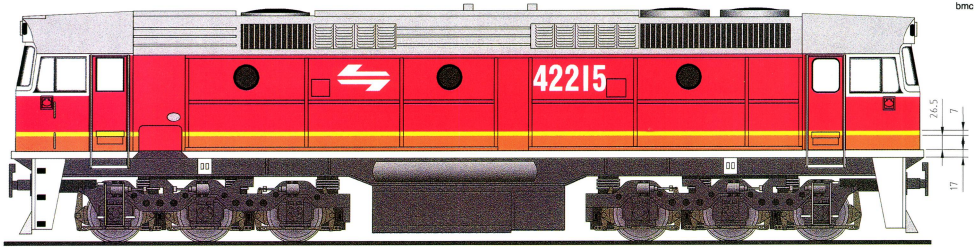
Body and roof	= Indian Red	Apron and pilot	= Indian Red (original)
Linework as shown	= Yellow	Apron and pilot	= Black (later repaints)
Cab front and brow	= Yellow	Horns (exterior)	= Indian Red (see text)
Handrails and steps	= Black	Horns (throats)	= Signal Red
Buffers and pockets	= Black	Window wipers	= Black

MISCELLANY

Whiskers are 7.1mm thick with 11.9mm gap between. Whisker end gap 4.8mm. Window and marker light surrounds left black.

Figure 91

NSWGR INDIAN RED



Side numbers and Logo 48mm high

COLOURS

Red Enamel	Dulux 393 35101 GP3
Medium Sea Grey	No.637 BS 381C
Black Enamel	
Golden Yellow	No.356 BS 381C : 1964
Orange	Dulux 393 31158 GP3
Off White	Dulux 393 33333

SUBSTITUTES

Holts Dupli-Color Nissan Beacon Red
Holts Dupli-Color Grey Primer
Mirotone Mirokey 747, Black #9999
Pascol Golden Yellow
Holts Dupli-Color Ford Tango
Holts Dupli-Color White Primer

LOCOMOTIVE COLOUR ALLOCATIONS

Body	= Red	Window Surrounds	= Black
Roof	= Grey	Handrails	= White
Pilot	= Black	Cab Steps	= White
Cowcatcher	= Silver	Frame upper edge	= White
Waistband up	= Yellow	Horns	= Grey
Waistband low	= Orange	Air cock handles	= White

NUMBERS & LOGOS

Helvetica Black for side and cab nos. suggest computer cut white vynyl and same for logos.

Front numbers 35mm high

Figure 92

SRA CANDY

Painting a Model Locomotive

by Ross Bishop-Wear

The following is a re-print of an article which first appeared in AME *in February 1990. It is so clear and concise that we thought it folly to write a general article on painting a diesel locomotive, as the same basic rules apply, whether it be steam or diesel. ... nrg*

Without doubt, the finished paint job makes or breaks a model. A good one can cover a multitude of sins, but, a poor one will make them all look worse.

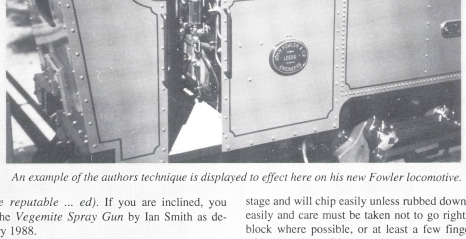
Painting a model locomotive as not (as many would have us believe) a long and complicated process, so if you expect to read a long and involved process here then you will be disappointed. Painting is easy, provided you take a bit of care, and understand and follow a few basic principals.

Equipment

First we should consider the equipment needed. So a few word on tools for the job won't go astray. You must at least have;

- An air compressor of at least 4 cfm
- A small spray gun
- A quality water separator
- A regulator
- A lot of patience

For fine work, an airbrush would be handy *(eg. Badger® and Paasche® brands are reputable ... ed).* If you are inclined, you could make one like the *Vegemite Spray Gun* by Ian Smith as described in AME January 1988.



An example of the authors technique is displayed to effect here on his new Fowler locomotive.

Surface preparation

Obviously the surface needs to be clean and smooth. Sharp edges should be radiused so the paint will cover them and not run back from the corners leaving them bare. I prefer to use *Zinc Anneal* sheeting for my platework (cabs, tanks and tenders etc), rather than brass or black steel because:

- It is easily formed into shapes,
- It is a snack to braze or solder,
- It is relatively cheap,
- It provides corrosion protection and,
- It already has a very good key for paint to adhere and can be painted over without primer.

However, we will still use primer. Obviously, the less scratches and blemishes on the surface the better, but the following method simply deals with file marks, rough finishes and accidental scrapes.

Dismantling

Components should be dismantled into major assemblies for proper access to nooks and crannies, although the more that stays together the better. On a steam loco for example, the boiler should be done with the smokebox, lagging and domes all in place. Just mask off the smokebox if there are two colours involved. This way, all but a few nuts and bolts get painted in the process, eliminating all but the smallest amount of touching up later. On a diesel, the carbody, cabs and bogies should be separated from the frame.

Priming

Due to the fact that there are bound to be a few copper and brass bits to paint, it is well worth a coat of etch primer. Traditionally, etch is a thin greenish stuff that goes on very lightly (you can see right through it), that prepares the surface for the primer to key into.

However, in recent years (1990) a high build etch primer has become available. I use Regal Aultraflux®, which is a two part mix. There is bound to be the same type of primer marketed by other companies.

"High build" means that you spray straight from the can with no extra thinner. It dries almost immediately and you re-coat until sufficient paint has been applied to fill any surface defects.

Allow the paint to dry and cure thoroughly, at least 12 hours in a warm room and carefully rub back with 500 or 600 wet and dry with lots of water. The layer of paint is still thick at this stage and will chip easily unless rubbed down. High build primer rubs easily and care must be taken not to go right through. Use a rubbing block where possible, or at least a few fingers in a circular motion with the paper. Rivets and other small protuberances need to be rubbed around to bring to bring the paint down to a uniform level and surface finish. However, take great care not to rub through the primer on the rivet heads or the tops of any other lumpy detail. Such protrusions cop a beating from over-zealous people with cleaning rags so we want a good paint bond to remain on them.

Keep rubbing until the high spots start to show through and leave the paint filling the grooves and hollows. Since we used Zincanneal sheet, a few areas of base metal exposed won't matter, but if you used brass or steel you'll have to do another light coat before going on to the next stage.

Colour

Choosing the colour of your locomotive is usually dictated by the prototype. However, those of you who are considering using your own or some other free-lance scheme should observe the following points.

- Some colours will attract dirt like a magnet, and no amount of cleaning will get the dirt off.
- Some of the lighter greens and yellows are especially are especially vulnerable.

Continued next page...

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- If you decide to use these light colours, then a coat of clear lacquer might be in order. Check that the lacquer is compatible with your paint system before applying.

Personally, I use enamel with a hardener for the finish coats. The reason for this is that wet enamels will "absorb" the overspray when working around detail components and as a result you will end up with a uniform finish.

There is enamel and enamel though (shades of *oils aint oils*). Basically, you get what you pay for. I have had a great run out of Dulux® products. The cheaper ones just don't seem to be anywhere near as successful, especially on the hots bits such as the smokebox. Saving $20 in the last couple of hours work on something you have spent years on, just does not make sense!

There are probably other paint systems to use, but as I am no formally qualified expert, I see no reason to change from good old enamel which has served me well.

Finishing coats

Pick a nice warm day with low humidity and no wind, then lay your pieces out in the sun to warm up. I've never struck such a perfect day when it comes time to paint but it is a nice thought.

Primer, by its nature, is porous and absorbs moisture from the air. It's very important to completely dry this moisture out before sealing it under the paint. Very gently playing a gas torch over the job will do the same if there is no sun. You will be surprised how much moisture comes out onto the surface.

Blow the job clean with air whilst lightly rubbing with a clean dry hand. Rags always seem to leave fur and catch in the detail. There is really no such thing as a lint free cloth when it come to preparing a surface to paint. So, again, use your hand or a soft brush.

When you think you're ready, spray on a light coat of colour, just wetting the surface all over. Leave for 10 to 15 minutes to go tacky. The tackiness will help the next coat to cling on and not droop into runs and drips. The second coat should be a full spray giving a complete cover. Do not overdo it, or it *will* run. If you are not too confident or in doubt, spray a bit light and leave, then have a third go to finish it.

When you are doing the second spray, try to reflect the light off the surface into your eyes as you spray. You'll find its easy to see when sufficient paint has been applied. The paint should run together leaving a smooth glossy surface. If there is insufficient paint cover, the surface stays dull and rough looking. This often happens out near the edge of the spray, so take care to overlap passes enough to eliminate these areas of overspray.

Always aim the spray gun at alternating angles and watch you don't miss edges. I get around this potential problem by doing the edges and fiddly bits first and then fill in the blanks. I find it's easier this way to see if you have missed anything.

Don't touch it

When you think it is perfect, then its time for the bugs to swarm all over it and stick to your still wet paint! Or should I say, if this does happen, *don't* be tempted to fiddle. Leave them be! When the paint is dry, you simply brush them off, breaking their legs off at the ankles and leaving their feet buried in the paint! Mostly, the tiny blemish left is really not worth worrying about.

If it is a bad one (and the bug died with a violent struggle), very lightly rub the whole area down with 600 wet and dry paper until the surface is dull all over. All that is required to bring up the gloss better than ever is one light coat of well thinned mixture. Again, reflect the light as before to be sure it is all covered.

Linework

Good linework on small things is very important and is not worth doing yourself if you're likely to botch it up. A vintage car and coach restorer/signwriter with lining out skills will save you a lot of heartache.

However, for better or worse, I generally have a go. If you go this way be prepared to have your patience tested and also be prepared to wipe it all off if you are not completely happy.

Signwriting suppliers can fix you up with tiny brushes or a lining pen such as a Rolls Liner®. Most of these gizmos defy instruction on their use. You just have to learn by practice and trial and error — lots of them!

In summary, all I can say is that good linework and signwriting is well worth the effort as it enhances a colour scheme tremendously. I just wish more people paid greater attention to it.

The secret of success is simply taking your time with the preparation, leave plenty of time for the coats to dry. If you make a bit of a blue, don't be too slack to rub down again and do another coat. It really is a lot easier to do than it has been to document here!

- At least one had the bogie steps painted silver (probably the one with the silver cowcatchers).

The paint scheme shown in Figure 91 is representative of what most of the class wore in their first dozen or so years of life i.e., 1969 - 1982.

NSWPTC Reverse

The reverse colour scheme was introduced by the then NSWPTC ostensibly to improve visibility of locomotives to the perway staff. It was called the reverse scheme because the colours on the cab fronts were just that, reversed! While the carbody remained "brown" and devoid of any lining-out, the cab ends were painted yellow and the whiskers painted brown. The front of the cab was treated to a very squarish V and the yellow of the cab front wrapped around the side in a wedge shape to accommodate the brown whiskers.

We have been unable to locate a painting schedule or drawing of the reverse colour scheme — this may answer why there were variations between locos wearing this livery. Three different variations of the reverse scheme have been identified and there were further variations in the logos and numbers locations.

Due to lack of accurate information on the reverse scheme, we have decided to limit our description of this livery to a photo. Only eight (possibly nine) of the 422 class were treated to the reverse colour scheme in the late 1970s.

SRA Candy

The appointment of a flamboyant chairman to head the new State Rail Authority also saw a lot of real and cosmetic changes to the states trains. This change of image also extended to a completely new livery for the fleet of diesel locomotives. At first thought of as rather garish by the purists, it set a new standard in raising rail transport profile with the bright colours employed. The locos were derisorily referred to as 12 wheeled candy bars. As everyone got used to the bright colours the scheme became universally known as candy.

Originally, most of the 422 class (exceptions were 42201, 42207, 42212 and 42220) were re-painted as they became due. However, as this re-paint took place over several years, the inevitable variations started to creep in. The representative painting schedule is shown in Figure 92.

The major points of the candy colours are as follows:

- Roof to the bottom edge of the mansard section is grey.
- The bulk of the body is red.
- Top thin waistband is yellow.
- Wide waistband is orange.
- The frame sill and apron/pilot sides are white.
- The brow to the cab front handrail is white.
- All handrails are picked out in white.
- The ligaments between the cabfront windows are black.
- Frame and bogies black.
- Cowcatcher is silver.
- Logo in Traffic Yellow.
- Cab steps, bogie steps, doorhandles, numbers, loco lifting lugs, coupler lever han-

The often described drab and unpopular reverse Tuscan scheme. It was allegedly introduced to make the locomotives more visible to the per way staff. Less than half of the class received this livery. The livery base was Tuscan which was much darker than the previous Indian Red.

Photo: Bill Kerr

dles, air cock handles, air pipe fittings and fuel filler caps painted white.

While the other classes were treated to severe variations of the candy scheme including the "red terror" variety where a red roof replaced the grey, from our observations, the alterations were not so radical on the 422 class. Some of the observed are:

- The cab fronts were painted matt black between the under side of the brow to the top of the sill under the front windows.
- Sometimes the white trimmings around the headstock were forgotten.
- The side and front numbers varied in size.
- The size and colours of the "arrows of indecision" (L7 logo) did vary somewhat from loco to loco.
- The logo appeared to be more often than not in white.

The candy scheme was the predominant scheme of the 1980s. 42201, 42207, 42212 and 42220 were never painted in candy. To my knowledge, at the date of writing (February 1996), very few of the class remain in candy, 4208 lasted until February 1996 and 42216 lost the candy in August 1995. 42203 and 42213 were sighted recently (January 1996) still in candy. Most of the remainder of the fleet have succumbed to the dreaded "Stealth Bomber Blue".

Freight Rail Blue

The Blue colour scheme started to appear about 1989 and as with any conservative paint scheme, it was introduced without fanfare. It is presumed that it was adopted as an economic measure. It could hardly be for improved visibility or safety as they are almost invisible at night.! The major points of the scheme are as follows:

- Main body and cabs all over blue.
- Yellow cab brows, aprons pilots, headstocks and upper frame.
- White numbers, handrails, cab steps, bogie steps and air cocks.
- White lower waistband between the blue and yellow.
- Bogies, lower frames, fuel tanks and air receivers black.

A full scale size reproduction of the Freight Rail logo.

- Freight Rail logo under each driver's and observer's window.

The representative Freight Rail blue colour scheme is shown in Figure 93. Note that locomotive 42207 is not representative as it has a much lighter blue than the rest. (It is almost a mid blue). 42218 is also not representative as the yellow and white banding is different to the rest of the class. It is more akin to the 82 class. Finally, 42220 remains in modified Tuscan with yellow whiskers at the time of writing (February 1996).

Painting tips for the 422

The accompanying boxed article by Ross Bishop-Wear gives the general method of painting locomotives and they are applicable to diesel locomotives as well. Painting diesels is generally easier than steamers. This is because they are mainly slab sided. Also, fiddly linework is not generally a feature of diesels. Broad colour bands are more the go here.

Measure and mark where the bands need to go on the loco. You may need to just put the tiniest of dots with a 0.2mm tip marking pen at regular intervals along the proposed line of colour change.

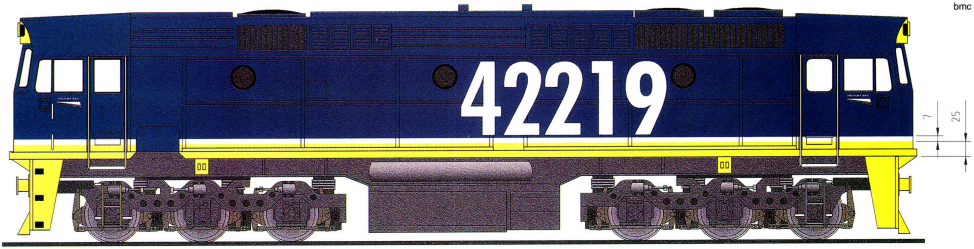
The locomotive is then best stripped to bogies, frame, cabs and finally main centre body section. Follow the priming and finish coat steps to get the base colours on the various sections.

Masking out for the banded sections is not the horror story that you might think. For a start, I don't use masking tape. Spraying up to conventional masking tape does not give a clean enough edge for my liking. I use 20mm wide 3M Magic tape®. Lay it along the edge of where you want the line to go, then put a couple of layers of paper overlapping the "overspray" edge of the magic tape, then stick the paper down with tape.

Spray the area, line or striping as required. Now here is where I break the rules. Remove

Two of the class resplendant in Freight Rail Blue. However, a close look reveals that 42218 is different around the yellow and white bands. The yellow band is thinner thus the white band sits lower than on the rest of the class which wear the blue. Thus 42218 is not representative of the blue scheme.

Photo: Ross Verdich



Side numbers 150mm high

COLOURS

Freight Rail Blue
Traffic Yellow
Off White
Semi-gloss Black

SUBSTITUTES

Pascol Military Blue
Pascol Daffodil
Holts Dupli-color White Primer
Mirotone Mirokey 747, Black #9999

LOCOMOTIVE COLOUR ALLOCATIONS

Body	= Blue	Glass surround	= Black
Pilot	= Yellow	Cab steps	= White
Frame upper	= Yellow	Bogie steps	= White
Waistband	= White	Coupler lift bar	= White
Cab brow	= Yellow	All Handrails	= White

LETTERING

Futura Bold Condensed for side and cab numbers suggest computer cut white vinyl for all.

Front numbers 47mm high

Figure 93
FREIGHT RAIL BLUE

the paper then carefully lift away the magic tape before the paint is dry. You should be left with a very clean edge to your linework. Where you have several lines close together (such as the whiskers if you are painting the loco in the Indian Red scheme), just mask up and do one at a time. De-mask and wait a couple of days for the enamel to cure then mask up the next line and repeat the procedure.

When the frame and bogies are complete, the bogies can be re-attached to the frame and the drive system re-connected.

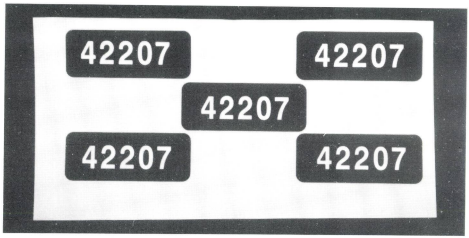
Plenty of patience and good forward planning for the locomotive linework should see your locomotive come up a treat and start to look the part indeed.

Colour proof strips

The colours of the locos reproduced in this magazine will not exactly match the shade of the outshopped locos. This is a fact of life with published material. So to help our builders get the correct colours, you can send us a self stamped and addressed padded post pack and we will return to you a small strip of metal with the colours painted on them. Make sure you specify the scheme you want. You can then go to your local enamel shop and they will mix a brew to exactly match our sample. That is just about a close as you can get.

Pascol paints are readily available in NSW. However, in Victoria they can be sourced at: IRO Fino, 319 Victoria Rd, Thornbury and their phone number is (03) 416-86046. For those further afield, it would be prudent to telephone Pascol headquarters in Sydney on (02) 666-4311 and ask for your nearest supplier.

Berger Paints also have listed on their charts Military Blue, Daffodil and Off White which may be suitable for the blue locos. We have not seen the Berger product in the flesh so we must escape by the usual disclaimer as we cannot substantiate the finished result.



The stick on illuminated number box numbers available from AME.

Bits and pieces

We used Humbrol Flat Black enamel for the outline of the rubber seals which go around the windows, cab number boxes, driver's and observer's window sills (if the windows are partially down) portholes and marker lights. This was applied by brush. A steady hand and a bit of patience is all that is required.

We sprayed the eight cab handrails and cab front handrails while sitting them on the ends that secure them into the cab. The cab steps were masked off and sprayed. Things like fixed handrails and bogie steps were hand painted.

Finally, the horns need their final coats. These vary according to the era you are painting in. However, if the inside of the horn trumpets are are a different colour, these can be picked out by careful brushing.

Number boxes

The two number boxes on each end of the cab above the main windows need to be fitted with their numbers at this stage. Before we start, get your small oval perspex windows out of storage and trial fit them into their respective openings, noting their orientation. Leave the protective paper on them at this stage.

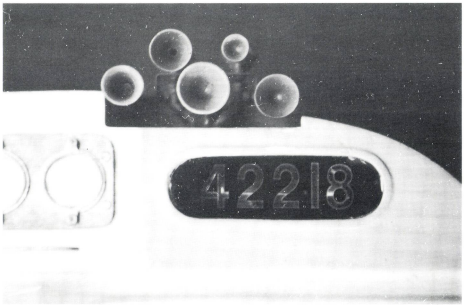
Now the numbers — they come in several different styles according to the colour scheme used. However, for our purposes we stayed with the one style. Nobody will notice the difference unless they have a comparative font style sheet in their pocket!

You can get them onto the locomotive in two ways:

1. You can scale them from the adjacent diagram up to just fit into the number boxes, and get them screen printed onto opaque white 1mm thick plastic film. Remove the protective paper from the outside of the window perspex and clear cement glue the plastic film.

The brow of candy 42203 showing the illuminated number boxes
Photo: Ross Verdich

The number has just been stuck onto the Lexan window and the trimming knife is being used to cut the excess away.



The illuminated numbers in position on our 42218.

N.B. Test the glue on a scrap piece of window perspex and 1mm film to see that the glue does not craze either of them.

2. The other method is to purchase your window box numbers from AME Retail. They come as a kit of five numbers (includes a spare just in case one is damaged) on a sticky sheet, a piece of clear sticky sheet and five white computer address labels.

The method is as follows:

- Tear the protective coating off what will be the outside of the perspex windows and put them down glass side up.
- Cut out the oval black numbers.
- Hold a window up to a strong light, and dry locate the number centrally in the glass. When you are confident, tear the backing of the number plastic (this will expose the sticky side) and again carefully locate the number centrally on the glass. Press it down firmly.
- With a craft knife, carefully cut away the excess black plastic film.

  Do the other three the same.
- Next, cut a rectangle of clear film. Remove the backing and stick it down over the number.
- Carefully remove the excess with a craft knife.

  Do the other three the same.
- Remove the protective backing from the inside of all four perspex pieces.
- Remove a section of computer label from its backing and stick it to the rear of the perspex.

  Do the other three the same.
- Place the first window number in position in its box in the cab front and tack it on the inside with a dab of silicone sealant (eg. Sikaflex®) at each extremity. Now place the cab casting on its back and wait for the sealant to dry.

  Do the other three windows the same.

More windows

While we are putting the finishing touches to the cabs, now is the time to put the main windows and side windows in position after removing the backing paper from the rear or inside. Again, a dab of *Sikaflex* in each corner and hold in position.

Do this to all the windows on both cabs. Then remove the outside protective paper from all the windows.

Attach you pre-made window sills to the partially open windows if you have them. We just crimped ours a bit and made them a push fit.

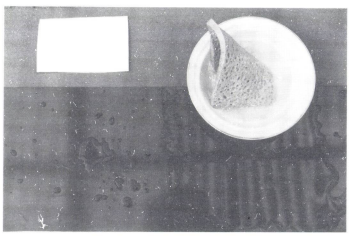
Re-install the window wipers to the loco, nutting them up on the inside. We did make an omission in the last part when we described the assembly of the window wipers. Because the wiper assembly mounting studs are so close, the nuts will not run down side by side. We got around this by simply making a small ferrule spacer 3mm long to go over one of the stud ends when they protrude on the inside of the cab. This means that the nuts sit at different heights, but at least they can both be tightened satisfactorily!

The cabs can now be offered to the frame and the electrics re-connected. Give the locomotive a full function test. The cab can then be fastened back onto the frame of the loco.

Horns and handrails

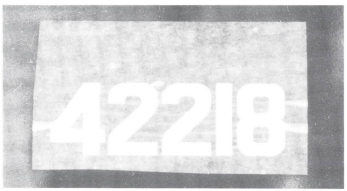
Next is to install the hornsets in their correct location. Our initial intention was to fasten them to the roof. However, when they are sitting in place, they look rather vulnerable to damage so we have employed an alternative fastening method. Put a dab of Sikaflex on the bottom of the hornset pad and sit it into its pre-drilled hole in the roof and that's it! When the sealant has dried, the hornsets will be held in place with their "flexible joint". The idea being, is that if the horns get a slight knock, the whole hornset will flex a bit. If the hornsets are knocked heavily, the sealant will let go and the hornsets will tear free of the loco and fall to the ground. This we consider to be more bearable then seeing the hornsets damaged due to an inadvertent knock, especially when the loco is manhandled during loading and unloading.

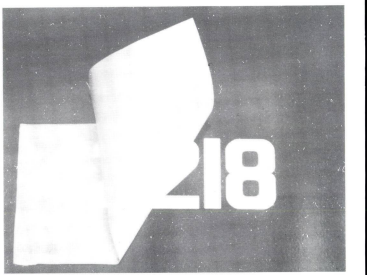
The cab and front handrails can now be permanently installed. Simply a dab of Loctite® 406 on each extremity and they can be pushed into their mounting holes and the ad-



Notice the surface on the right hand side of the photo has wetted better than that on the left, due to detergent added to the water mix.

The vinyl transfer has been applied and can be slid around on the wetted surface until it is in the correct position.





Above *shows the vinyl transfer after application and all the water and bubbles squeegeed out. The top layer is nearly dry.*

Right *shows after the commencement of removal of the top layer. This must be done extremely carefully and slowly to avoid any chance of the vinyl lifting up and getting stretched and deformed.*

hesive allowed to cure. Eight cab door handrails and a cab front handrail at each end.

If the doorhandles are a different colour, as on the candy and blue locos (where they are white), carefully hand paint them the correct colour. Use a soft bristle artists rush.

Locomotive numbers

There are a three ways the numbers can be applied to the locomotive — namely:

- By hand painting them on from the information given on the adjacent pages and photos. You would need to have some skill in this area or employ a good signwriter.
- The 1990s method is to have them vinyl cut to your outline. You supply the numbers size and style to a vinyl cutter (most signwriters now have this facility) and they will do the rest.
- The AME team have access to a specialist engraver-signwriter who can turn out vinyl cut patterns and numbers to our specifications. We are supplying him with details of our numbering requirements and have had our locomotive numbers cut this way. We are very satisfied with the results.

If you wish to go this way then you can place an order through AME and we will have them cut and forwarded to your specification. For us to complete your order, we need the following information.

Name and Postal Address

Your locomotive number

Your selected colour scheme

Your return phone number so we can quote the cost.

The costs vary according to the scheme you elect i.e., Tuscan, Candy, Freight Blue or Bi-Centenary, with Tuscan being the least expensive and Bi-Centenary being the most expensive. By the time you read this, we should be able to quote you firm prices.

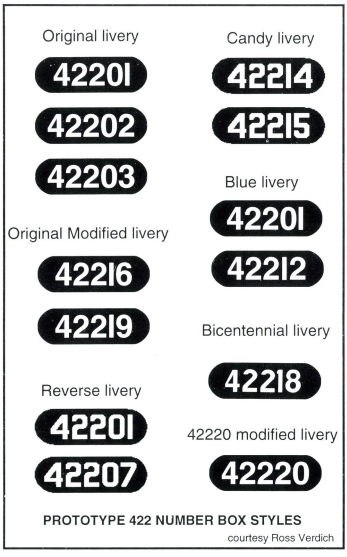
Orders by mail or fax to (048) 85 1179 or (02) 646-1362. Also can be phone ordered on (048) 85-1179.

Fixing the numbers

Glueing the numbers on is a fairly straight forward task.

First, cut out each number group in a rectangular block. Trial (dry) fit the numbers in their position by holding them at the intended position on the loco. This is purely to give you a lay-of-the-land so to speak. Then put all the number groups aside. Now proceed as follows:

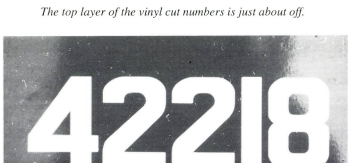
- The surface to accept the numbers needs to be prepared with a wetting agent. If you pre-wet your loco side with water, the water will globulise and this will make the application of the vinyl numbers difficult. So, put a few drops of dishwashing detergent in a bowl, mix it in and then pat it onto the surface to make a thin even film over the area where the transfer will be fixed. This is the wetted surface to which we will fix our vinyl cut transfer.
- Select the first transfer and carefully remove the backing from it. Do not let the sticky bit double over on itself otherwise you will have to scrap that number.
- Offer the number to the wetted surface and carefully position it exactly where you want it. If your surface is wetted freely (in other words had a full unbroken layer of water on it) the vinyl cut transfer will sit easily and slide around smoothly.
- From the centre and carefully wiping towards the ends, squeeze out all the bubbles and water from underneath the numbers and paper topping. Do this until all signs of bubbles and water have gone. A "borrowed" Wettex® from the kitchen sink does this job very well.



PROTOTYPE 422 NUMBER BOX STYLES

courtesy Ross Verdich

The top layer of the vinyl cut numbers is just about off.



The complete vinyl cut number set after final removal of the top layer and patting off any remaining moisture.

Repeat the last four operations until all the numbers are fixed to the locomotive.

When the top layer is near dry, it can be carefully and slowly peeled off. This then leaves the vinyl number in position on the locomotive. Where the number goes over a rivet head, poke a pin hole through the vinyl near the bottom of the bubble and gently squeeze out all the excess water. Where the vinyl jumps over panel cover strips, the vinyl will sit off the main body panel a bit where it lifts up to the panel strip. This is fixed by running a sharp trimming knife (a scalpel is ideal here) along the vinyl at the change of direction. After it is cut, press it firmly to the base surface. Any gap in the vinyl can later be carefully touched up (filled) with white enamel.

Logos

The "Arrows of Indecision" (L7 logo) and the Freight Rail logo as under the drivers and observers door are available from AME for $10 for a set of each including pack and post. Same address as when you order the numbers. The same method of siting and attachment is used as per the numbers.

Where to see the prototype

The 422 class have been hired by National Rail Corporation for use until the delivery of their own locomotives. They can be seen on the high speed superfreighters between Sydney and Melbourne nearly every day of the week. They are invariably working in-the-shafts behind V*line* G class or SRA 81 class. Good spotting places where you can see them stationary in NSW are Cooks River yard or Delec (both in Sydney) and at Junee where they stop for crew change. For seeing them in action, the Exeter Bank is as good as any, and around Breadalbane, Illabo or Gerogery if you wish to eat their dust. In Victoria, Dynon is their stop-over point and around Wandong or Chiltern are good action places to see and hear them working hard.

Anyone who is wanting to further their personal research on the class would be advised to move smartly, because, as National Rail take delivery of their new locomotives, it is expected the 422s will be returned to NSW Freight Rail. Since the locos are approaching the end of their economic life it would be reasonable to assume they will be withdrawn off the active roster immediately and set aside.

Acknowledgment

A special thanks to Ross Verdich for his assistance in supplying information on specific areas of the 422 class colour schemes and for the use of his and Bill Kerr's photographs which accompany the colour rendered diagrams.

The Finale

The final part of the 422 construction series will detail locomotive 42218 as it was painted in the NSW bi-centennial colour scheme in 1988.

To be concluded ...

422 class builders

Anyone who is building a 422 class and who may be approaching completion or is finished, are invited to send in photos of their trusty steeds with any relevant information specific to your locomotive.

If suitable we will publish it as part of our final part of the 422 class series... nrg.

Speed Control

For Electrically Driven Model Vessels

By Keith Grove

Photos by the author, drawing for publication by Rod Heslehurst

A friend of mine asked me if I could build a speed control similar to the one described in the article 'STS DILYSIA' which appeared in AME of July-August 1993.

I don't have either the workshop facilities or the skill to duplicate the control as described, but, I figured that something adequate could be made using printed-circuit board material with a wiper made from shim brass.

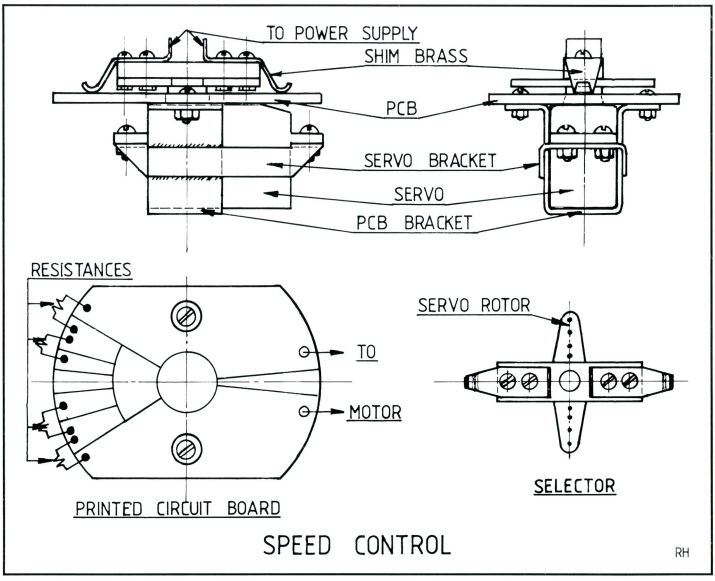
Initially I thought of following the original design, which has the control mounted independently of the servo and connected to it by a link. However, on further consideration, I thought it should be possible to mount the PCB on the body of the actuator with the selector attached to the servo cross. This proved to be the case.

The drawings below, which are full-size, along with the enclosed photographs will, I hope, show how this was done. The control gives stop, two intermediate speeds, and full speed, forward and reverse. The construction is so simple that I would be surprised if it hadn't been thought of before.

The PCB is made to be a snug fit on the servo and is secured by the simple bracket, which passes around the servo and which is secured to the PCB by two bolts and nuts. Note that the copper is removed from the PCB where these bolts are situated, as a short circuit will otherwise ensue. The two shim brass sections of the slider, which are sufficiently wide to bridge between segments to prevent dead spots, are mounted on a piece of perspex (or acetate sheet) which in turn is mounted on the servo cross. The perspex is possibly not necessary; I used it to avoid putting strain on the servo cross.

The PCB can be etched in the normal fashion by covering the areas *not* to be etched with a material impervious to the etching solution or by carefully removing the unwanted copper with a Dremel® tool or similar. This is a relatively quick way to do it, but it needs more care to ensure that only the copper, and as little as possible of the base material, is removed. In the drawing the copper is removed where the lines are drawn. If these units were to be produced in any quantity — for example as a club project — I recommend having the boards prepared for etching using a silk-screen to apply a suitable paint or using

Continued on page 42...



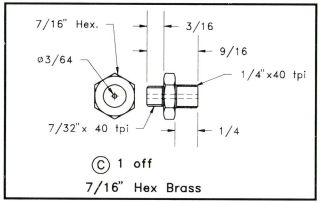
Automatic Steam Cut-off Valve for Vacuum Brakes

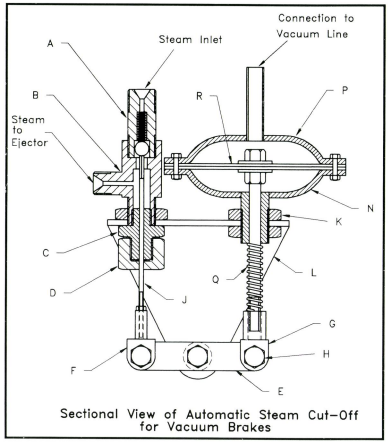
by N.R. Decke (Tauranga NZ)

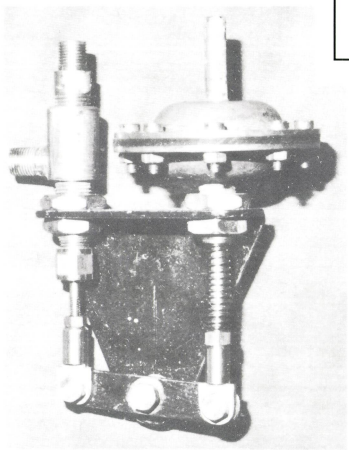
Drawings for publication by Peter Manning. Photo by Neil Graham

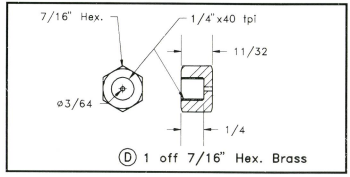
A good series on fitting automatic steam brakes on a 5" gauge driving car in *Model Engineer* from 20 April to 16 November 1990. I adapted the brakes, complete with ejector and controls, to fit on a 3½" gauge Britannia. However, I wasn't satisfied that steam could not be cut off when the desired vacuum was reached. I devised an automatic cut-off which works very well. This is how I made the vacuum brakes, using the castings designed for a vacuum limit valve.

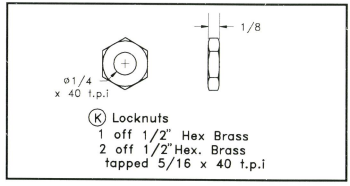
One side of the casting is fitted with 3/16" OD copper pipe for vacuum. (On Britannia it was put on the top for convenience as shown, but it can be fitted anywhere to suit). The boss on the

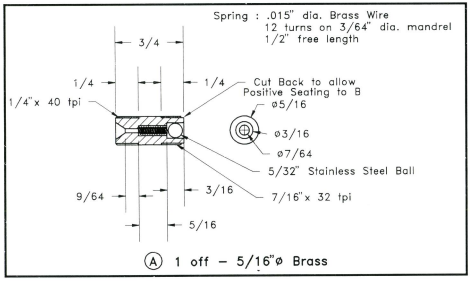


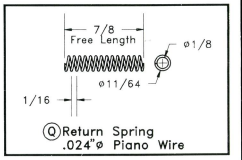




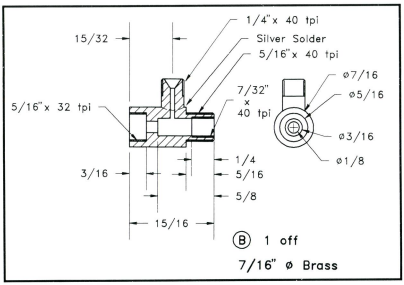


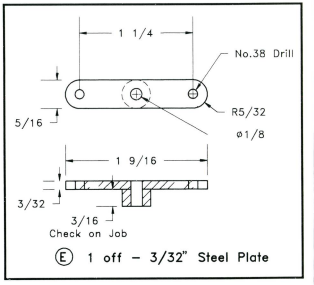


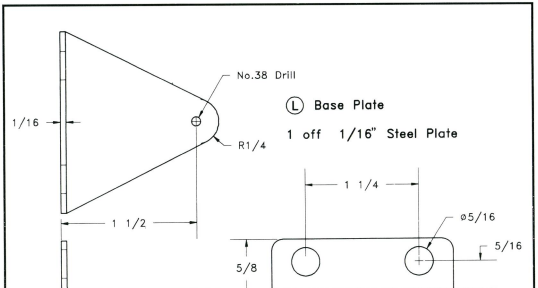




other side is machined and threaded 5/16" x 40 with a 1/8" hole drilled in the centre. After centring and fitting the rubber diaphragm, dismantle and open out the 1/8" hole to 5/32" to give free side play to the piston rod and to act as a breather hole. The size and shape of the base plate is not critical, but the positions of the holes are. This plate is then mounted on a







suitable bracket in whatever position is best suited to individual requirements — on Britannia, it was mounted between the rear driving wheel and the pony frame, at an angle of 60°. All the fittings are straight machining jobs and should not require any further explanation. The bolts holding parts E and F to lever D should be a neat fit but free moving, and are held on with a lock nut. Elongate the hole on part F carefully with a rat-tail file to allow free side-play to compensate for the arc movement of the lever. The hole on part E does not require this, as play has been allowed for by enlarging the hole in the casting. The pivot bolt for the lever is similar to the two above except that the distance from the shank to the shoulder is longer. When these three bolts have been tightened with the lock nuts, the lever and the knuckles should be perfectly free.

Assembly

The assembled cylinder is attached to the base plate through one of the 3/16" holes with a lock nut either side, and tightened with the 3/16" vacuum pipe in whatever is the appropriate position. Then take part B, screw on the lock nut up to the shoulder and put it through the other 3/16" hole. Screw in part C firmly and bring back the lock nut to hold it in place with the steam pipe to the ejector pointing in the right direction. Then screw in part A, the steam inlet with spring and ball. This spring only needs to be strong enough to return the ball to its seating when the 3/64" push rod is withdrawn. The push rod can be put in and sealed with the gland nut and graphite packing. Care must be taken not to have this nut too tight: just tight enough to stop steam leaks, but as free as possible.

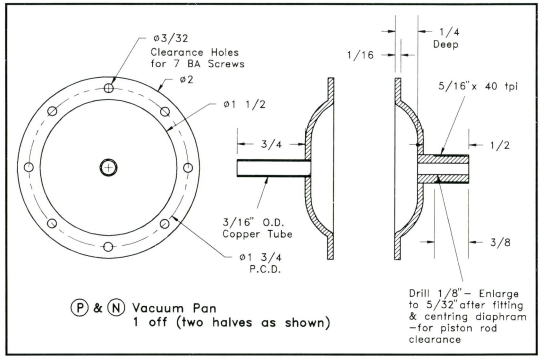
The knuckles can be screwed on the push rod with a lock nut on first. The cylinder rod does not require a lock nut as the diaphragm stops it from turning. Of course the spring and adjusting nut must be put on before the knuckle is screwed on. The lever can now be slipped under the knuckles and fastened.

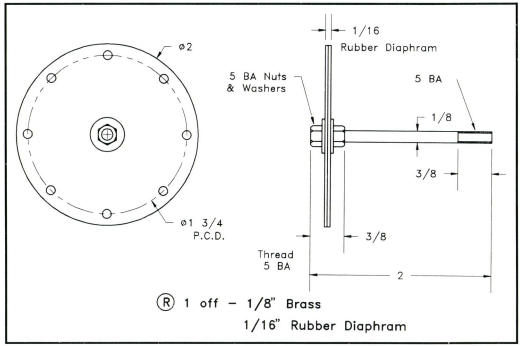
Pipe connections

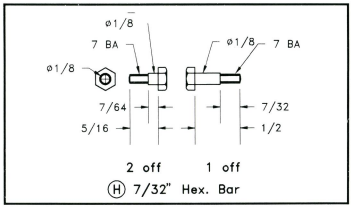
Steam enters the steam inlet from the manifold through a shut-off valve and goes out through the connection on part B to the ejector, which is mounted in any convenient place. Vacuum from the ejector goes to the brake valve with a T branch to the 3/16" pipe on the cylinder. The vacuum valve on the ejector must be absolutely air-tight. After experimenting with various balls and seatings I found the most effective was an o-ring. When vacuum is created it pulls the rubber diaphragm and compresses the spring on the rod. This of course pulls back the push rod and allows the ball to seat, cutting off the steam supply. When the vacuum drops off, the spring takes over and pushes the push rod on to the ball, allowing steam to the ejector.

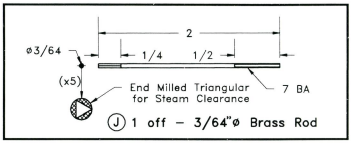
The final adjustment requires a little time and patience, but it is possible to adjust the mechanism to the point where the valve cuts off steam and opens again with only 1 pound variation in vacuum. There seems to be a critical balance point in the rubber diaphragm and it is a matter of finding this point.

Before putting the bolts and lever in position it would be advisable to adjust the diaphragm. To do this, hold the diaphragm in the central position, as near as you can judge, then screw the knuckle in or out until it will connect to the lever in mid position.









Then bolt the knuckle to the lever. Now turn on the steam or air to create the vacuum. By adjusting tension on the spring, or by screwing the push rod in or out, maintain the diaphragm and lever still in the central position until vacuum is up to the desired point. Screwing the adjustment nut in or out does not alter the amount of vacuum but merely shifts the position of the diaphragm and lever. The amount of vacuum is controlled by the position of the push rod. Screwing it forward (towards the ball) will increase the vacuum. Screwing it backwards (away from the ball) will reduce the vacuum. The closer the cut-in and cut-out points are, the closer will be the difference in vacuum, high and low. If the difference is more than one pound it may be necessary to shift the adjusting nut in or out until the critical balance point is found.

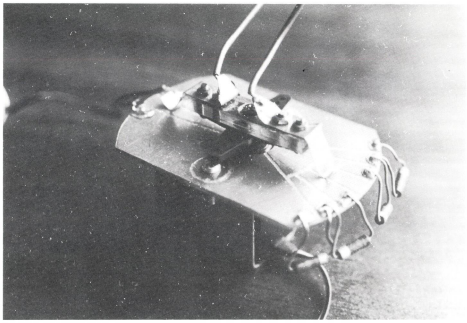
Remember that every time you alter the adjusting nut it will be necessary to alter the position of the push rod. This is where time and patience are required — but it is very satisfying when you can hear the steam snap on and off every time with about one pound variation in vacuum!

Continued from page 38...

the "photo resist" process. The board as shown below is suitable for Futaba and Sanwa servos. You might need to change the design to accommodate other brands of servo.

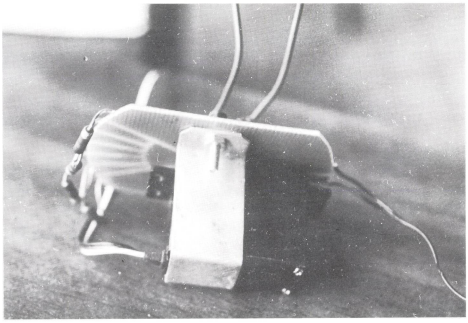
I imagine the board would have a finite life but it would not be a big job to replace it. The life will depend to an extent upon the amount of current drawn by the motor and the severity of any arcing as the selector arm passes over the various segments of the board. The pressure of the selector arm against the board will also have a bearing on the wear; it should be adjusted so that the pressure is the minimum consistent with adequate contact.

It is impossible to give values for the resistors, as this will depend on the current drawn by the motor and the voltage required at the various settings. The values are best determined by trial and error, but the power rating of whatever resistor is selected is important. This is determined by the formula I/R, where I is the current in amperes drawn by the motor and R is the value of the resistor in ohms. This would give the minimum power rating of the resistor. However, in practice it would be preferable to select a resistor of twice this rating to minimise heating if sustained operation at one of the intermediate speeds is envisaged.



Top view of the speed control, showing the engraved printed circuit board and resistors.

A theoretical example might help. Imagine the motor runs on 12 volts and draws a quarter of an ampere and that the resistance in circuit is 16 ohms. Applying the formula gives 0.25 x 0.25 x 16 = 1 watt. A resistor rated at 1 watt would run quite hot if in use for a prolonged period. A rating of 2 watts or more would be preferable. Alternatively resistance wire, as described in the original article, may be used.



Bottom view of control showing the PCB bracket

Garden Locomotives

General design principles for simple reliable locomotives

By Paul Trevaskis

In the "garden gauges" there are many tricks that can be employed to get something up and running quickly. A simple locomotive, steamed by a pot boiler with either gas or spirit firing, can be powered by a single-cylinder oscillating engine with a bore of about 8mm and geared down at least eight-to-one. A loco of this type will trundle along pulling a couple of coaches and leaving a great plume of steam. Radio control is not needed, as they do not go fast enough to get into trouble. They are fun and quick to build, and will draw comment from other loco owners as they go so slow and put on such a good show!

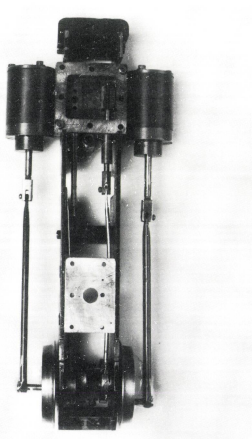
Recently I found the remains of a "thing" I once built. With outside frames and cylinders, it was geared down three-to-one and the axles were chained together inside the frames. The loco was interesting to watch with the motion going one way and the loco the other. Heaps of steam, noise and action, but little forward motion!

The more typical loco uses two double-acting cylinders outside the frames. Slide valves are more common among scratch-builders. For a reliable engine, slip-eccentric valve gear is hard to beat.

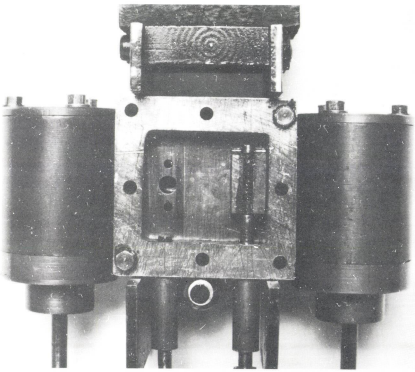
Suspension requirements

There is no need to provide suspension to all axles for a simple engine. If an engine with two fixed axles keeps derailing, then you really should be looking at your track for a cause. Making the main drive axle fixed and providing the others with springs will give a smooth-riding loco, instead of the usual coil spring per axle box. A piece of spring steel bearing on the centre of an axle will provide enough travel to smooth out any bumps. Just remember to keep it oiled!

Slots cut into the frames will serve instead of the axle horns used in the bigger scales. By the time these wear out, so has the rest of the locomotive! If you do not want to buy wheel castings, slice off some steel rod and turn it to the correct profile to make excellent wheels on an outside framed loco. For inside framed engines a few holes drilled in the wheel can give the appearance of Boxpok type wheels.



The complete chassis of a garden gauge locomotive with slip eccentrics.



A close-up of the cylinders and slide valve. The long end covers and valve rod guides stop leakage.

Controlling the speed

Small-gauge locomotives were originally designed with small bores, proper slots for ports and huge steam passages. LBSC's *Bat* is a good working example, with ⅜" bore and ⅝" stroke. Locos with small bores tend to run away. To throttle back to scale speed, you have to really cut back the steam: the loco will then fail on the first incline or curve for want of more throttle. This is where radio control comes in. However, the small cylinders still require careful driving — it is rather difficult to maintain scale speeds. One foot in one second is about right for 10 miles per hour.

There are some things that can be done to build a more controllable loco. Increasing the bore to ½" or 9/16", re-working the valves to give very little lap and, perhaps more importantly, reducing the ports to holes. The loco becomes much more controllable and will work quite well on 25 pounds of steam. When the train meets a gradient, the loco slows to allow the valve chest pressure to build up, but does not fail. The train will crest the rise and continue along at a realistic speed.

With passenger-hauling locos in larger scales, the steam ports are designed to admit

the steam with as little loss in pressure as possible. This is where these little engines differ. On the valve faces there is no need to use slots for ports. Simple round holes work just as well and are so much easier to make: 2mm is fine for steam ports and 3mm for exhaust. If you keep the lap down to about 1mm or less, your loco will run like a clock and will be easily controlled.

Valve gear

As I mentioned before, slip-eccentric valve gear is hard to beat: just try to keep the valve rods as long as possible. Doing so will make valve-setting easier and valve events and general running smoother.

The question of building glands and slide bars has caused some animated discussion over the years. If building a simple loco, then you can get by without them. These little engines rarely have a stroke of more than 25mm. Providing the back cylinder cover is made at least 16mm long and of hard brass or bronze, there is plenty of support for the piston rod. There is no need to build a gland if the back cover is long enough and a good fit. The same applies to valve rods. I have an engine built this way, which is more than five years old and does not leak.

While castings are available for a number of small scale locos, please bear in mind that fabrication is very easy in this small scale, and cost effective. For $25 you can get a 300mm length of 32mm bronze rod which will give you at least three sets of cylinders. The other way is to use thick-walled bronze bushes for cylinders and solder the valve chests together. This method works well if making the bore accurate is a worry.

Lubricator

A small displacement lubricator will keep the works oiled. If it dumps the oil all at once, look for a leak somewhere. Otherwise you will have oil all over the track, which soon attracts grit, wears things out and builds up on wheel flanges. It also wreaks havoc with the pickups on electric trains.

Boilers and firing methods are another matter, to be covered next time.

If you are good at kit-bashing you can buy a running chassis from Roundhouse in the UK and use whatever boiler you like.

Whatever you decide to build, don't be afraid to have a go. Because the individual parts are small they can often be made from scrap, and the cost is negligible.

A quick word about machinery. In locomotives of this size, tolerances are tighter than for the bigger scales. If the bore is a couple of thou oversize, the cylinder will be useless. Therefore your lathe must be accurate. Do not pick up some old contraption thinking it will do. Errors tend to compound, not cancel each other out. You will quickly become despondent and lose interest. Find someone who knows what to look for. Small lathes such as the earlier Unimats are ideal for small locos. They are accurate and extra accessories are easily built.

Small Spotfacing Cutters

by Ken Gifford

Drawings for publication by Ken Gifford

Using silver steel rod, you can quickly and easily make cutters for spotfacing flanges and covers such as cylinder covers fixed with small bolts.

With the rod in the chuck, machine the outside diameter of the fledgling cutter by ten to fifteen thou (0.010" to 0.015") larger than the distance across the corners of the hexagon boltheads or nuts which will be used on the flange. Turn the end of the cutter blank two to three thou less than the diameter of the hole to be spotfaced, machining the length equal to the diameter. Lightly chamfer the end and recess the shoulder slightly.

With a selection of needle files, form the cutting edge by filing the clearance and rake, leaving just the narrowest cutting edge. Make sure that it's formed for the correct rotation!

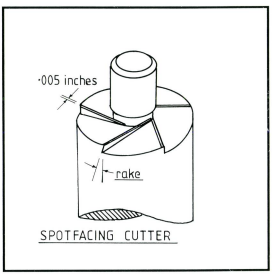
You will notice that the teeth are not equally pitched radially. This is done intentionally to reduce the incidence of chatter.

Rake

The rake will depend on the material being machined: negative rake for brass or cast iron, a degree or two of positive rake for aluminium or steel.

Hardening

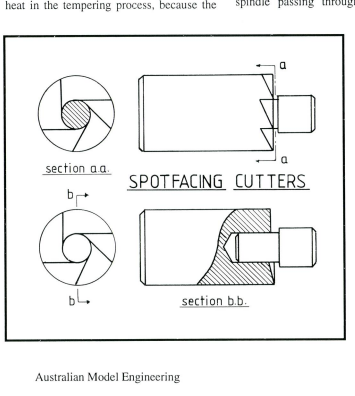
To harden and temper, heat the end of the cutter to a bright cherry red, quench in water, then re-heat to a mild straw colour and quench again. Do not use too much heat in the tempering process, because the centring pin is quite small and will break off if it is too hard and thus very brittle.



Variable pitching of cutters and reamers

When I was an apprentice, I read about parallel reamers with straight flutes variably pitched to prevent chatter. The theory is that the cutting edges of a reamer drop into the marks of the preceding cutter and amplify the chattering. A good example of this is the way a common twist drill under some conditions forms a cornered hole.

I did not come across a variably pitched reamer until years later when at sea as an engineer on an old ship powered by a blast-injection diesel engine. The fuel valves had a spindle passing through a gland made of many whitemetal ring sections. (This gland had to seal off air pressure of 1000 psi). When the valves were overhauled, new rings were fitted and a hand reamer was passed through. Even though it was white metal being reamed (which is very susceptible to chatter), a perfect finish was obtained. Hence the variable pitch spotfacing cutters.



Psyche Bend Pump

Notes on Restoring a Priceless piece of River Murray History

by Warren Williams

Travelling in north-west Victoria late in 1995 with my Family, I found myself in Mildura. An advert in the local Sunraysia Visitors' Guide for the Psyche Bend Pump took my attention. I decided to visit the site, and discovered a marvellous restoration job is being done by a small group of dedicated and competent volunteers.

The engine and pumps operated continuously from their installation in 1891 until 1959, when electric power took over. The pump-house is situated among trees on the banks of the River Murray. Bricks were made and fired nearby when this purpose-built brick building was erected in the 1880s.

The pump was needed for the irrigation network by the Chaffey Brothers late last century. George (1848-1932) and William (1856-1926) came from Canada in 1867 at the invitation of Alfred Deakin, the Victorian Minister for Water Supply, later to become Prime Minister. The reason was to set up an irrigation network.

George (an engineer) and William, had been involved in setting up an irrigation scheme in California, USA. Their idea at Mildura was to pump water from the River Murray into a billabong and from there allow gravity to feed the channels to all the participating properties. This was quite a step forward for the time, as the irrigated land was several times higher than the lift of the pumps.

George Chaffey designed and developed his own steam engine for the proposed new installation. Tangyes of Birmingham (England) built the engine and pumps to these designs. As the design was so radical for the time, Tangyes cast the name Chaffey on the engine rather than their own.

The four-cylinder triple expansion engine has cylinder diameters of 16", 24" and two at 31", producing 1000 horsepower at 160 revs/min.

The engine is coupled to three centrifugal pumps each capable of 8000 gallons per minute. Total output with three pumps working 24000 gallons per minute or 1.44 million gallons per hour.

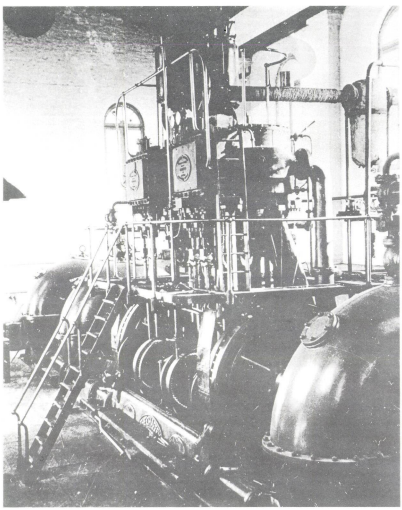
The original boiler was of Hawke manufacture; a second was added about 1917. Shortly after the change-over to electricity in 1959, both were sold for scrap when the boiler-house was demolished and the pump station doors were bricked up. This in some way helped to preserve what can be seen today, although it did not stop scrap metal thieves cutting the connecting rods to get to the bearing brasses.

The idea of restoration received a boost when in 1989 the HBC granted $40000 towards a survey/conservation analysis. Results were positive. Over the last six years, members of the Sunraysia Steam Preservation Society have been working on the project, expending more than 10000 hours of voluntary labour.

With support from the Mildura Lions Club the Society bought an ex-Victorian Railways N class locomotive boiler in as-new condition. It will be located on the site of the original boiler-house and a new building will be erected around it.

The opening

The Psyche Bend pumps and new boiler-house complex were officially opened and recommissioned on 11 October 1995. The pumps again pumped water, witness by a gathering of about 450 people. The complex will be an asset to understanding the history of the area. Needless to say it is well worth a visit!



Pump viewing times

Non-operational: Sundays 10am to 1pm. Tuesdays and Thursdays 1pm to 4pm.

Operational: 11am to 4.30pm; Saturday 10 June, Sunday 29 October, Sundays 21 and 29 December

The Sunraysia Steam Preservation Society

Before the group became involved in the Psyche Bend project, members had been restoring a 2 foot gauge locomotive: a Hunslet built at Leeds in 1901. It travelled well for a small locomotive, as follows:

- 1901 — India.
- 1903 — returned to England for rebuilding, then shipped to Mt Lyell (Tasmania).
- 1921 — to Cobdogla (South Australia).
- 1924 — acquired by the Victorian State Rivers and Water Supply and used in the Red Cliffs area till 1953.
- 1953 — to a local park.

Subsequently it was removed and restored, and is to run again — this time as a tourist railway just south of Red Cliffs. The train at Redcliffs is now all set and ready to run, (as at October 1995) subject to accreditation.

The Preservation Society is only a small group with just over a dozen dedicated members. Their address is:
Sunraysia Steam Preservation Society Inc.
PO Box 204, BURONGA, NSW, 2648

References:

Psyche Bend Pump publicity material
The World Book Encyclopedia
Australian & New Zealand Encyclopedia

Thanks to Les Williams and George Cullen for their guided tour and help with material for this article.

An Elevated Re-birth

The rebuilding and extension of the elevated track at the Queensland Society of Model and Experimental Engineers, Brisbane

by John Elsol

The Society was formed in 1932. For many years the dream of having a permanent club track remained unattainable, and members ran on their home tracks for running days. For a time a track was laid in a park at Yeronga on Brisbane's south side, but the arrangement did not last long.

In the late 1960s, the club leased five acres of land at Strathpine, now known as Warner, to establish a permanent club track. In 1986, the club bought this land to ensure the future of the site.

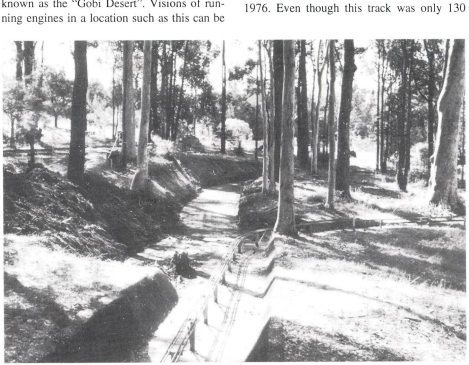
The undulating terrain ensured some interesting features such as cuttings, banks and bridges. Members built a ground level track for the larger locomotives of 5" and 7¼" gauge, and an elevated track for the smaller locomotives. Many years of work passed before the track was continuous around the property. Work continues to this day on improvements to the ground level track.

Elevated track

The members quickly put down a track on the ground for the smaller engines. It ran around a dam at the rear of the property, using track reclaimed and donated from the private railway of Eric Evans at Kuraby. The track saw service for about five years in this location but was not popular as the dam, which was often dry, was in an area of the property known as the "Gobi Desert". Visions of running engines in a location such as this can be easily imagined so another more suitable location was sought.

Partial rebuild/deviation undertaken during 1991. The dog-leg section of track (on steel posts) on the lower left can be clearly seen.

A start was made on an elevated track closer to the front of the property, again using Eric's track. This work was completed in 1976. Even though this track was only 130 metres long, it was a safe, permanent elevated track. Although one day the elevated track was going to be extended, finances and more pressing projects saw this work put in abeyance for many years.



Earthworks in progress. The cutting for the elevated track extension.

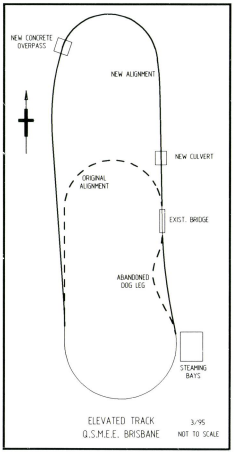
Part rebuilding

The first signs of an extension was in 1991, when a deviation of the down side (on the embankment) was undertaken to eliminate a dog leg. The opportunity was used as a trial for the future extension and rebuilding of the track. Instead of perpetuating the steel post form of construction, the method adopted was similar to the elevated track at Mooroolbark in Victoria.

A concrete base 450mm wide was poured on which ¾ size concrete blocks were grouted about 1.5 metres apart. Next, steel formwork was bolted to the blocks and the section between was infilled with concrete to form a continuous elevated base for the realigned track. Only one monthly running day was interrupted while the track was reconnected. After a good trial, we decided to use this form of construction for the extension. The diagram shows the original elevated track, the realignment and the new extension.

The extension

Early in 1992 the committee approved commencement of the extension to the ele-



vated track. A survey of the proposed route was undertaken and an easy grade was adopted. Long and cross sections were drawn. The route necessitated extensive earthworks in the form of an embankment approximately 2 metres high and a long cutting also some 2 metres deep at its maximum point. Survey pegs were placed to indicate the extent of the cut and fill areas. A drott excavator was hired to do the initial earthworks. Another survey was then undertaken to determine what remained and a backhoe finished off the earthworks. One section near the existing cutting of the original track was left to be excavated by hand so as to keep the existing track in operation for as long as possible.

The new top curve taking shape. Some of the infills can be seen.

The earthworks were complete by August 1992. The new top curve, although only 30 foot radius, was now designed with transitions at each end, adequate curve widening to 5 1/16" and cant.

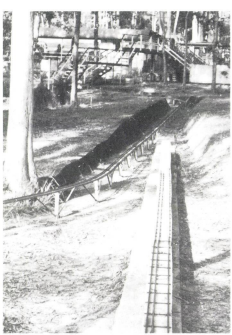
To speed up construction, some extra steel formers for the concrete infills were fabricated by a local TAFE college.

The order of construction was:

- Lay concrete strip,
- grout blocks,
- pour concrete infills,
- lay track.

Progress at times seemed slow, but one process had to be completed before the next one could commence. The original track was kept in operation throughout this period.

New steel was purchased for the track early in 1994. The steel from the section of track to be abandoned was reused. All new steel was straightened before welding. When the time came to re-use the old steel it was too difficult to straighten, so more steel was bought to finish off the project. The steel used for rail was 20x10mm and for the sleepers 12x3mm. No timber was used under the steel sleepers.



The new track creeps up to the original circuit, which was still in operation.

Concrete is being poured for the new base. Steel posts mark the remains of the old track.

Blockwork and concreting was complete by early 1994, except where the track was to join the original circuit. Track welding commenced soon afterwards with as much as could be done without affecting the old track. Finally the old circuit had to be cut and three running days, i.e. three months, were to pass before a continuous circuit was available again. The first running day on the new track took place in October 1994 and the official re-opening was held on the November running day. The length of the elevated track is now about 180 metres.

Other work remains to be done to bring the track up to more acceptable standards. For example, rebuilding the existing old curve, widening the handrails on the bridge, adding handrails to the new culvert and extensive modification to the steaming bays and locomotive unloading area. This will all happen in due course.

Setting up and welding the new top curve.

Above and right: The new track in operation.

South African Steam in South Australia — Corrections

There was an error in the drawing on page 13 of AME issue 65 of John Wakefield's article. The drawing shows the teflon piston ring with a -.003" internal diameter. The ring won't work with this dimension, it should have been +.003". The corrected drawing is shown on this page.

The following loco characteristics were accidentally omitted from the article.

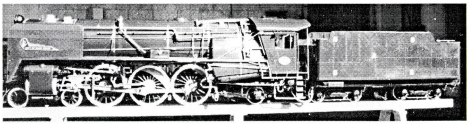
Locomotive No. 860. Unclassed 16F based on the South African Railways 4-6-2 class 16E. Built by John Wakefield, Adelaide, SA, 1994.

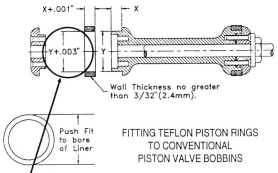
Scale 1½" = 1ft; Gauge: 5"; Length: 108"; Width: 15"; Weight in steam: 1110 lbs; Driving wheel diameter: 9"; Bronze cylinders: 2¾" bore, 3½" stroke; Teflon valve rings with trick porting.

Walschaerts valve gear in lieu of R.C. poppet.

Copper boiler, 8" diameter.
4 x 1½" dia. superheater flues.
16 x ¾" dia. fire tubes.
Grate area: 104 square inches.

Our apologies to John Wakefield for the error and omissions from his article.

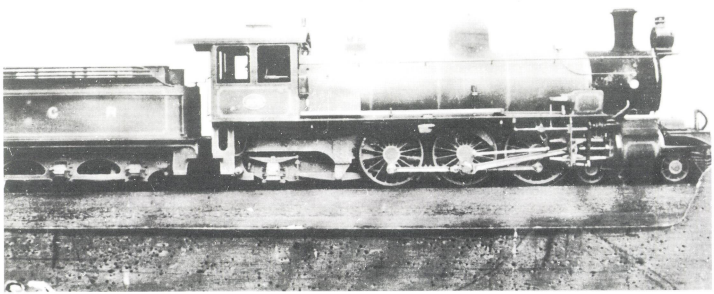




Site of error in the previous drawing.
This drawing has been corrected to +.003".

Compound Locomotive Prototypes

by James Tennant



North British works photo of Cape Railway's No. 900 4-6-2 with a running number 000.
Courtesy of Transnet Heritage Foundation, South Africa

I'd like to pass on a summary of results of my research into non-geared 1-high-pressure/2-low-pressure compound locomotives.

I have estimated that there were 464 of this type of compound built or rebuilt between 1876-77 and 1951.

Table 1 and Table 2 detail the locations, numbers built and wheel arrangements of the type. There are too many individual locomotives and classes of locomotives to be mentioned here.

There is a common belief that the French Nord *Sauvage* 2-6-0 built in 1887 was the first example. In fact it was the third example. The first example was an obscure English tram engine built in 1876-77, designed by a Peter Willans. The second was an obscure Russian prototype built in 1881.

One example that is similar to Australian 1067 mm gauge 2-6-2 and 4-6-2 prototypes is the South African Cape Railway's No 900 4-6-2. This locomotive was built in 1906 by North British Locomotive, C/N 17600. A works photograph shows the running number as 000, reflecting the "three pot club" status of the locomotive. The high pressure cylinder measured 19" x 26" and the two low pressure cylinders measured 21.5" x 26". The expansion ratio is 2.26. Total heating surface was 1583 sq ft and the firegrate area was 26.5 sq ft. Table 3 shows sources of data for this locomotive. Enclosed is a works photograph of No 000, by courtesy of Transnet Heritage Foundation.

Other than the two largest classes shown in the tables, most of the other locomotives were experimental. The experiments ranged from testing this compound system to testing boiler configurations, such as the Schmidt ultra-high-pressure closed-circuit system on four examples, and the La Mont forced circulation system on a 2-10-2 in East Germany in 1951.

Table 1: Non-Geared 1hp 2lp compound steam locomotives [tank class(es)]

Continents, Countries and Railways:	Year:	Wheel Arrangements:	Comments:
EUROPE			
Italy			
- Railroad Meditteraneo	1905	4-6-4T (6)	
NORTH AMERICA			
USA			
- Erie	1914-16	2-8-8-8-2T (3)	Six cylinders
- Virginian	1916	2-8-8-8-4T (1)	Six cylinders
SOUTH AMERICA			
Chile			
- Junin	1895-97	2-6-4T (3)	762mm
Total		13	

Table 2: Non-Geared 1hp 2lp compound steam locomotives [tender class(es)]			
Continents, Countries and Railways:	**Year:**	**Wheel Arrangements:**	**Comments:**
AFRICA			
South Africa			
- Cape Government	1906	4-6-2 (1)	1067mm
AUSTRALASIA			
Australia			
- New South Wales Government Railway	1893	4-6-0 (2)	LaPage system
EUROPE			
Austria			
- Aussig Teplitzer Eisenbahn	1902	2-6-0 (1)	
- Österreicheisch Nordwestbahn	1904-05	4-6-0 (4)	
- Staats Eisenbahngesellschaft	1905	2-6-0 (10)	
	1897	4-4-0 (1)	
Czeckoslovakia			
- State	1949	4-8-2 (4)	
France			
- NORD	1887	2-6-0 (1)	Sauvage design
- Societe National Chemin de Fer	1940	2-12-0 (1)	Six cylinders
	1946	4-8-4 (1)	Chapelon design
Germany			
- Deutsche Bundesbahn	1925,32	4-6-0 (3)	High pressure boiler
- Deutsche Reischbahn	1951	2-10-2 (1)	La Mont boiler
- Konoglich Preussische Eisenbahn Verwaltung	1903	4-4-4 (2)	Kuhn/Wittfeld system
- Wurtemberg	1892	0-10-0 (5)	Klose design
	1892-93	2-4-2 (10)	
Ireland			
- Great North of Ireland Railway	1932	4-4-0 (5)	1600mm
Russia			
- (Struwe, Kolomna)	1881	? (?)	Second of type
Switzerland			
- Gottardbahn	1894	4-6-0 (1)	
- Jura/Simplon	1896-1907	2-6-0 (147)	Weyerman design
UK			
- (Hunter and English)	1876-77	Tram engine	First of type
- Great Central	1905-06	4-4-2 (4)	'Jersey Lillies'
- London, Midland and Scottish	1929	4-6-0 (1)	'Fury' Schmidt boiler
- Midland/LMS	1901-32	4-4-0 (240)	'Midland Compound'
- North Eastern	1898	4-4-0 (1)	Smith design
NORTH AMERICA			
Canada			
- Canadian Pacific	1931	2-10-4 (1)	Schmidt boiler
USA			
- Baldwin	1926	4-10-2 (1)	Water tube firebox
- New York Central	1929	4-8-4 (1)	Schmidt boiler
Total		451	

The NSWGR P6 (later re-numbered to the C32 class) and Erie and Virginian 'Triplexii' are the only examples without a cylinder between the frames.

Table 3: Available data on South African Cape Railway EXP1 No 000 4-6-2 three cylinder compound	
A. Photograph: Source - Transnet Heritage Foundation, PO Box 3753, Johannesburg, South Africa, 2000.	
B. General Arrangements: Source - Transnet Heritage Foundation, PO Box 3753, Johannesburg, South Africa, 2000.	
Drawing Number	**Description**
A 1-257/830	Index (one sheet)
A 3/830	G.E. (elevation and plan)
A 4/830	G.E. (end views)
A 5/830	G.E. (tender)
A 10/830	Boiler
A 22/830	Firebox
A 45/830	Smokebox
A 117/830	Cab
A 178/830	Motion Arrangement: HP (elevation)
A 179/830	Motion Arrangement: HP (plan)
A 180/830	Motion Arrangement: LP (elevation)
A 181/830	Motion Arrangement: LP (plan)
C. References:	
1 Frank Holland: The Steam Locomotives of South African Railways 1859-1910, Purnell SA 1971, pp 73-75	
2 Bernard Zurnamer: The Locomotives of South African Railways, pp 27-29	
3 A E Durrant, C P Lewis and A A Jorgenson: Steam In Africa, Struik SA 1981, pp 181-183	

Repairs To Locomotive Boilers on the Victorian Railways

Rivet Replacement

by Doug Baxter

Drawings for publication by Ian Flower

Electroysis between dissimilar metals causes them to corrode. Mild steel rivets were used to connect the flange of the firebox tube plate and the firehole plate to the inner wrapper of boilers with copper fireboxes. After about 10 years, the rivet heads on the water side would waste away.

The corrosion was usually revealed by a blow of steam at the caulked edge in the firebox about a foot above the foundation ring. A fitter would re-caulk but if steam blew through again it was certain the heads of the rivets on the water side were wasted away. The boiler inspector would make a through inspection through the inspection holes next to the foundation ring and most probably would recommend the engine be transferred to the workshop for repairs. Rivets were usually ¾" in diameter, driven into a $1\frac{3}{16}$" hole by a hydraulic riveting machine. The heads of rivets on the fire side were usually in perfect condition.

Repair method

The method of repair was to select a rivet next to the blow, centre-pop the centre of the rivet head, and rig up a portable pneumatic drilling machine with a ¾" drill, proceeding with care so as not to run off-centre. When the flutes of the drill were flush with the plate, the machine would be removed and, using a hand hammer and a sharp flat chisel, the remains of the head would be removed. The drill would be checked to confirm it was running in the centre of the rivet. If all was correct continue to drill, or if it was not on centre it would be corrected by using a round-nose chisel or a smaller diameter drill. The driller would estimate the thickness of the two copper plates — usually over one inch — and when the flutes of the drill were at this depth he would remove the machine and using a suitable size drift would lightly tap out the shell of the rivet. It would drop down in the water space and be retrieved through the inspection plug hole.

A close inspection would find the head shaped as in figure 1. The reason for lightly tapping the drift was not to spring the plates apart,

Before proceeding to the next rivet it was necessary to apply a ¾" bolt. A ⅜" nut was attached to a long piece of string, dropped through the hole in the firebox and retrieved through the inspection plug hole. The nut was removed and a tee-headed bolt about 2" long (with the point prepared as in figure 2, and to which about 10" of light copper wire was attached) was fastened to the string. The bolt was fed through the inspection hole, the string pulled up till the copper wire came out the hole, and the wire was pulled until the point of the bolt was at the hole. With a little bit of jiggling the bolt was pulled through the hole, the nut threaded down the copper wire, the threads picked up and the nut tighten up.

Tee-headed bolts were used because in this case it was required to keep the plates tight together lengthwise, which was achieved by grinding the flat on the point, as in figure 2, in the same direction as the tee. All bolts in the boiler shop were tee-headed bolts.

The same drilling and bolting procedure was carried out above and below the initial rivet until full-sized heads were reached. Standard Whitworth taps of 11 threads per inch were available from ⅝" diameter to 1" by 64ths. Every second bolt was removed, and ⅞" tap would be put through first using a tank pneumatic drilling machine (hand held), followed by increases of 1/32" until $31\frac{1}{32}$" was reached, after which a $63\frac{1}{64}$" tap, followed by a 1" tap, which would be put through by hand to obtain a perfect, uniform thread in each hole. A sample test piece using a similar procedure would be done in a piece of 1" thick copper for the turner to use as a guide for a good fit.

The length of the studs was equal to the thickness of the plates plus three threads on each side of the plate. The studs were applied with a standard stay runner. When each stud was correctly applied it was usual procedure to give it about six blows with the ball pein of a two-pound hammer (figure 3). The remainder of the bolts were removed and the same procedure carried out. Each stud was then completely riveted over with the pein of a hammer, then the edges pegged down with a drift and finally whipped in. The seam was then caulked in the method applicable to copper.

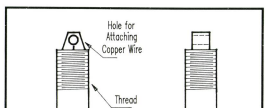


FIG 2 "T" Head Bolt

Broken rivet detection

On rare occasions, particularly with barrel seating for washout plugs, a steam blow would be noticed. If after caulking it continued to blow, the usual cause was that the rivet had broken, often at the junction of the plate and the mounting. By tapping with a hand hammer, the break could be proved. The rivet was drilled out using the same procedure as in copper firebox rivets, and was countersunk and tapped until good full threads were obtained (usually 1" diameter). A button stud (figure 4) was applied with three threads protruding into the steam space, and the stud was pulled up tight by a square spanner that just fitted over the ⅝" square top. When tight by hand, a pipe was then applied to the spanner handle and further pressure applied until the square was sheared off. The edges were then pegged down with a drift and whipped in. This same procedure was also used at the outside corners of the foundation ring. When it was necessary to replace a rivet in either a foundation ring or solid firehole ring the following procedure was used.

Foundation rings are between $2\frac{1}{2}$" to $3\frac{1}{2}$" wide (depending on the class of boiler) plus the thickness of both inner and outer plates

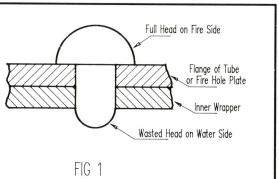


FIG 1

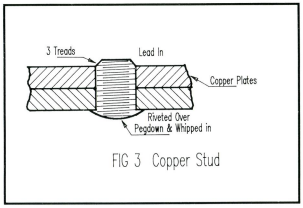


FIG 3 Copper Stud

(about 1") plus about 1¼". Therefore to form the crown countersunk head we arrived at a length of between 5" and 6". Foundation ring rivets were always 13/16" diameter for 7/8" holes in the ring. The procedure was to select a rivet about 1" longer than required, apply the standard bridge reamer 7/8" from each side to make clearance, heat the head end of the rivet to a white heat for half its length, quickly quench the point and apply the rivet to the hole. The trades assistant would then thump the head up hard and continue to hold on to the head with the dolly, about 15 - 20 pound in weight. Two boilermakers (one right-handed and the other left-handed) would strike the quenched point with standard riveting hammers, causing the rivet to thicken up at the head and along half the shank. Hammering would cease when the rivet lost its colour, that is back to a black heat.

Before removing the rivet the top would be marked with a centre pop, if there was a burr at the point it would be filed off. Cut to length, the rivet was heated again until white hot with a sparking heat at the point, applied with the centre pop at the top, and thumped up while held on by the dolly with the two boilermakers forming the head at the point end. When riveted down completely the edges were pegged down and whipped in as for button studs.

Other riveting styles

Two other forms of riveting associated with locomotives are cold riveting and water-tank riveting.

In the initial manufacture of locomotive main-frames, the axle-box horns are hydraulically riveted. After a number of years, penetration of oil into the rivet hole via the scale from the hot rivet causes them to loosen. To replace them as it is not practicable to use the portable hydraulic riveter they are replaced with cold rivets. With the rivets removed by drilling and bolted in the correct position, the holes were reamed with a rose reamer till a clean hole was obtained.

The rivets were turned from mild steel as in figure 3. The point of the rivet was turned to the exact size of the hole for about ½" to give it a lead into the hole, and the remainder of the shank was turned one or two thousandths of an inch oversize, depending on length and material. This was called a good driving fit — that is the rivet was driven in up to its head with a flogging hammer, and when driven home the head was held on by the trades assistant with a holding-up hammer weighing about 20 pounds. The boilermaker and his assistant worked in unison, both striking the head and point of the rivet at the same time. After the point had been laid over, the edges were finally pegged down and the centre of the rivet was maintained by the use of a large centre pop to facilitate future removal. Cold rivets were knocked down single-handed by a boilermaker using a riveting hammer of about 55 pounds (figure 5).

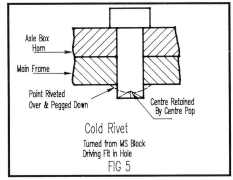


FIG 5

Until the late 1930s, tender tanks were of a riveted design, mainly joined together by the use of plates and angle iron with ½" rivets. The method of obtaining a water joint was by placing strips of tar paper between all water-tight joints. Tar paper was used to line packing cases of goods shipped into the country. It consisted of two layers of heavy brown paper within lay tar and sisal. The riveting process was carried out by the white-hot rivet burning the paper and sisal, and melting the tar which sealed the joint. The same procedure was used in the manufacture of railway water tanks for the transport of water to wayside stations.

When perfectly shaped in-line rivets are required on the outside of steel passenger cars — as on the *Spirit of Progress* — the method was to have a correct size snap for a medium-sized pneumatic gun. The rivets were applied white-hot from the outside: the boilermaker would apply the gun to the head of the rivet, the trades assistant would hold onto the point with a suitable dolly, and on squeezing the gun trigger the snap would vibrate the rivet causing the dolly to jump up the point, with the head remaining the same shape. This method is called "Yankee in rivets" — probably the method originated in America. When a point of a rivet to be formed is required to be the correct diameter but only half the height, it is called a half-dummy or a "Liverpool head", — perhaps the type used in the ship yards at Liverpool.

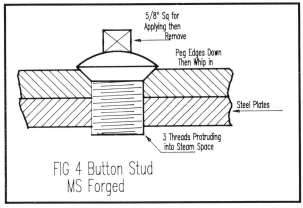


FIG 4 Button Stud MS Forged

Have you developed some interesting workshop item?

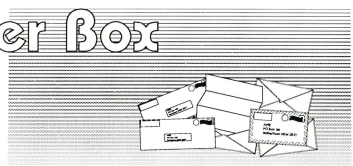
Perhaps a novel approach to locomotive construction?

Maybe tracked down a traction solution?

Any contribution to further model engineering in Australia and New Zealand would be welcome.

If you are not sure how to go about it, just ask for our Authors Guide or phone (02) 649 5301 or 018 022 209 to discuss your ideas.

Letter Box



Hegel and Parting Off

Sir

"What history teaches us is that we never learn anything from it." So wrote Georg Hegel the German political philosopher. Someone else said: "Those who do not learn history are doomed to repeat its mistakes".

What has that to do with parting off?

I was researching gear cutting and used Henri Larose's ME index to discover the series by Mr. Jacobs. In one issue I also came across an article by Mr G.H. Thomas on parting, totally by accident. It had never occurred to me to look up parting. Yet his series of articles about March '76 shows that he must have done more and written more about it than anyone. He came close to discovering the nitty gritty of parting, that of the virtual hinge and the significance of whether the line joining the hinge to the tip of the tool passes above or below the lathe centre line, but without quite getting there.

He did however bring up the matter of chip jam, which I didn't discuss and which though unrelated to dig-in, is equally important. I've broken a parting tool blade just because of chip jam.

Among other things, Mr Thomas investigated the merit of having a concave V on the top of the tool, concluding that it is probably beneficial because it bends the chip slightly in the middle. Unfortunately it's a difficult thing to grind.

Now I didn't mention in my Shop Hint on parting that the Rimet tool has a V-edged top, only the V is convex upwards!

I don't know whether this is the magic answer to chip jam and if it is, how it works, but the tool does work well and never jams — provided you also keep the surface of the cut moist with cutting oil constantly. Within a few revolutions without oil, you can hear the cutting become harsh and grating. Then chip jam is likely to occur soon.

If you maintain oil on the cut constantly by trailing some bristles of a camel hair brush wet with drops of oil, in the cut, it will cut sweetly and there will never be a chip jam. use Rocol Ultracut cutting oil and can recommend it, but be warned, just putting a couple of drops on the cut at intervals isn't enough. As soon as the cut exposes a new surface on the steel, the effect is gone. While cutting oil is critical with steel, you don't need it with bronze, brass or cast iron. However it should also be used with aluminium.

A pumped cutting oil emulsion directed into the cut would probably work just as well and would be less hassle, but haven't tried it.

To sharpen this tool simply grind the front face for the front clearance. I don't touch the top other than with a slip stone. That implies zero top rake for steel but it has the merit of making the tool correct for brass and bronze and therefore of universal applicability. That is how I use it, one tool parts everything.

So the moral from Herr Hegel is that we should always look up past references in the model engineering literature if we are not to be doomed to reinventing the wheel, repeating other peoples' work, or their mistakes.

Henri Larose's index (US$50) extends from 1950 to mid 1994 and although it has some blemishes, it will find the more than 40 references to parting in M.E. that have accumulated over the years. Pre-1950 it's of no use. All you have to do then is wade through them without getting side-tracked!

Peter Dawes

NSW

Motive power

Sir

Some time ago, I helped my son overhaul a small outboard motor. We actually made one motor out of two and ended up with the gear parts of the second gearbox spare. Here was the basis of a forward/reverse reduction gearbox for an internal combustion locomotive. All that has to be done is to build a steel box around the gears and provide a lever to operate the dog clutches. A very similar gearbox is fitted to most of the fixed wheelbase diesel locomotives used in the sugar industry.

Of course a proper clutch would also be needed for smooth starts and to avoid damage to the gears. One way is to buy a stationary engine already fitted with a centrifugal clutch, another source is under the seat of the average ride-on mower. These mowers are usually fitted with forward and reverse disc type clutches which are normally held in drive by a foot pedal. An over centre lever could be arranged to hold the clutch in drive or the lever could be arranged as a "dead man's handle" on a locomotive. The centrifugal clutch is preferable with a spring loaded throttle so the engine is disengaged and returned to idle if the throttle is let go.

I hope the above suggestions will be of benefit to any reader who is considering building an internal combustion locomotive, particularly one with a fixed wheelbase.

Peter Lukey

Qld

Balls!

Sir,

I sympathize with M C Rachow (Letterbox March/April AME) and his difficulties with so called rustless balls in locomotive feed water systems.

I have been down a similar path although in my case it was more a matter of balls seizing on their seats in between sometimes lengthy periods between use. Partial success was achieved by leaving enough water in the tender to cover the pump. This approach worked reasonably well but there had to be a better way!

One answer was the use of rubber nitrite balls available in 'a great' range of sizes from several UK suppliers. These worked well on existing valve seats provided there were no sharp edges to damage them.

In my case the seats had been well and truly hammered to a smooth state by the continual pounding of original steel balls. I also found that I could drain the tender with confidence that the valves would operate at our next running session. I may have been content to let matters rest had it not been for the discovery of a relative newcomer in engineering circles.

While making a purchase at a local bearing supplier I was told about a newly developed plastic ball which is designed for use in aggressive environments. Among its uses was as a check valve. The product is named Torlon®, and the balls, available in a range of sizes are made from a poly (amide-imide) material which is claimed to have some remarkable attributes.

I obtained a small sample of sizes from the supplier and fitted them throughout the feedwater system. This was some 18 months ago and I have had no problem since. The balls seal very well, are low in 'mass' and hence hammer is virtually non existent. Based upon my experience I would be happy to suggest that these balls are certainly worth a try. I have found no problems whatsoever and it is nice to be rid of the "furry ball" syndrome.

The balls are available through Bearing Service outlets and are imported by Sheedy Bearings of Victoria. The only difficulty is that they will be supplied in lots of 100, nothing less, so this is an area that our model trade suppliers may wish to examine for supply in smaller quantities.

In closing, may I say what a great experience it was to ride behind John Wakefield's South African class 16F at the Wollongong convention in 1994. The photo on the front cover of AME and the subsequent story within helped to relive those memories.

I wonder if John could be persuaded to do a little story on his rotating engine stand?

Jim Crawford

WA

News Desk

compiled by Brian Carter

The thought of meeting old friends from distant parts of the country, an AALS convention, and your wife and children want to go, and you've been flat out lately, should you tear yourself away and go?

Well, I did, and we had a marvellous time! But AME is two weeks late as a result. The compensation is that a full pictorial report will be in the next issue.

Area Representative

We welcome John Wakefield to the AME team as the South Australian Representative. John has been an active AME supporter for many years. To our South Australian readers, don't hesitate to give John a call if you need assistance on local AME matters.

60 class books return!

In the previous issue of AME I announced that we had no more supplies of this excellent book on the mighty NSWGR Garratt. However, they have been re-printed and AME Retail have fresh supplies! I don't think they will last long, so don't waste time placing your order!

Tullamarine Society move

At the AALS convention, the indefatigable Wayne Roberts had an interesting backdrop to his trade stand: a 2-metre long plan of the new track which the Tullamarine Live Steam Society (Melbourne) envisages for a new site. Last year, they received news of having to close up to make way for a new freight terminal on the outskirts of Tullamarine Airport. Since then they have been busy looking for a new site. The site featured in the plan is seven kilometres further out from town, at Bulla.

One of the problems when a new club starts out designing a track plan is that they don't learn of mistakes until they've finished building. It's interesting, therefore, to see a plan prepared by people who really know what they are doing. For a start, the minimum radius will be a generous 21 metres. Station, steaming bay and workshop designs seem "spot on". Earthworks will be no small matter: scrapers will probably be needed, some 9000 cubic metres of soil will be moved, the deepest cutting will be 4 metres deep and the highest embankment or bridge will be 4 metres high.

The team here at AME sends our very best wishes to the Tullamarine members. All power to your elbows!

15" gauge Royal Mail stamp?

I received an interesting letter from Peter Flaskamp of Germany. He is trying to convince the UK Royal Mail to produce a stamp to commemorate the 150th anniversary of the birth of Sir Arthur Percival Heywood. The anniversary is due in 1999. The stamp would feature a profile of Sir Arthur Heywood, *Muriel* (one of his locos) and a bell (Sir Arthur was an active campanologist and composer).

However, Peter has discovered it is possible in principle, but that there is a lot of competition to get special stamps issued — Royal Mail receives about 2000 requests per year! Royal Mail suggested that he start lobbying straight away. So Peter is appealing to all AME readers to send a postcard each, with a suggestion for a "Sir Arthur Percival Heywood" stamp to:

Royal Mail
Royal Mail House
22 Finsbury Square
London EC2A 1NL
United Kingdom

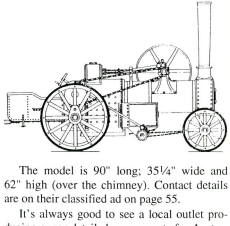
In brief: in 1873 Sir Arthur Heywood (1849 - 1916) developed a 15" gauge rail transport system (after experiments with 4" and 9" gauges) to replace the more expensive cart system in use on his estate at the time. He built six 15"g locomotives which ran on his own and the Duke of Westminster's estates.

The locomotives: *River Irt* (0-8-2; ex *Muriel*, 1894) is still in service on the Ravenglas and Eskdale. *Katie* (0-4-0; 1896) is just being restored. *Ella* (0-6-0; 1881) was cut up in 1922, but the chassis is still in use as part of the chassis of 4-6-4 diesel engined *Shelagh of Eskdale*. All 0-6-0 and 0-8-0 engines were equipped with a special radiating axle (to negotiate extremely sharp curves) invented by Heywood.

Trade and commercial

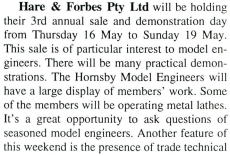
Live Steam Models Limited (UK) are now offering a 5" scale Foster Rope Hauling Engine. This unusual engine is a single cylinder, chain driven machine with one road speed. There were few prototypes built, most of which went to Argentina to work on the prairies.

No differential is fitted and there is only one eccentric — the engine is non-reversible — although a slip eccentric could be fitted.



The model is 90" long; 35¼" wide and 62" high (over the chimney). Contact details are on their classified ad on page 55.

It's always good to see a local outlet producing super-detailed components for Australian products. **Scobie and Glover** Sheetmetal's Rolling Stock and Detail Components have announced a new Butterfly door kit (right in photo below) suitable for NSW C38, C36 and D59 class engines. And a dummy Stones turbo generator (left in photo). Other new products are coming soon



Hare & Forbes Pty Ltd will be holding their 3rd annual sale and demonstration day from Thursday 16 May to Sunday 19 May. This sale is of particular interest to model engineers. There will be many practical demonstrations. The Hornsby Model Engineers will have a large display of members' work. Some of the members will be operating metal lathes. It's a great opportunity to ask questions of seasoned model engineers. Another feature of this weekend is the presence of trade technical representatives to help answer those special questions you might have.

We're all in it together

On the way back from the convention, I was pondering many things — the Hay Plains does that to you! One thought was: where would our hobby be without those small traders who go about their business more as a labour of love than anything else? They have a marvellous range of goodies that you can't get hold of without ordering from the other side of the world — or clubbing together to buy "minimum quantities" so large that you'll ever wonder if you'll ever use them.

When I talk with the small operators who advertise in AME, it's often apparent that they have a strong loyalty to the magazine and the small-time model engineer. That's reflected in their good service and advice.

We all want to see our hobby and its supporting "industry" grow. Let's stick together. For me, that means resolving to use our trade supporters whenever I possibly can.

Classifieds

Auction of 5" Gauge Rolling Stock and Boats

- 1 Pacific Steam Loco, 1 RC Railcar, 1 RC MU, 1 Ride-on Shunter, 30 Goods and Passenger stock, 2 RC Boats. All in top condition. Very realistic reserves. Date 8 June 2pm. Send DL size stamped addressed envelope for pictures and map where to go etc. to: Rail Auction, PO Box 276, WYONG 2259

Incomplete 7¼"g Heidi & Components For Sale

- Tender 50%, coal bunkers and smoke stack formed, boiler barrel and frames cut. Components include boiler tubing, bearings, all castings and drawings, regulator valve, pressure gauge etc. Price $1500. R. Donchi, Phone (051) 34 3217

Expressions of interest

- Are invited from individuals, clubs and trade related people to be involved in a combined MODEL EXHIBITION WEEKEND to be held in Bendigo in 1997. It is envisaged that it will involve model railways, aircraft, ships, meccano models, working or static models, wooden, plastic or metal. If interested, please reply to: Peter Robinson, President. C/- 132 Olympic Parade, KANGAROO FLAT 3555

7¼"g Locomotives for sale

- 7¼"g 0-4-0 Tank Loco with steel boiler riding/water & coal truck. $3000. ono
- 7¼"g *Marie Estele* 0-4-0 Rolling Chasis all part machined 6" Copper Boiler Burrell $1000 ono. View both in Melbourne. Ph. Jeff 014 015903

7 1/4" Gauge Loco Parts For Sale

- Denver and Rio Grande C19 2-8-0. Plans - 4 cyl. castings, 2 cyl sleeves, 2 sets frame material, eight drivers, copper boiler barrel 25 1/2" x 9 1/2" O.D. x .165" wall. $650. Ph. Les (044) 64 1304

3½"g Rob Roy For Sale

- Martin Evans design. Rolling chassis. Half completed boiler. One cylinder finished. All castings, boiler materials & fittings. Plans & construction manual included. $750. Ph. Alan (074) 45 5786.

3½"g *Britannia* 4-6-4 Loco For Sale

- Running, Boiler tested $3,000. Ph John (054) 73 3284

3" Atkinson Steam Wagon For Sale

- 90% complete - Motor runs. Boiler tested. $6700 (cost of materials) Body finished & painted, only pipe work remaining. Phone A. R. Major (071) 25 3702

5" gauge C38 — 3830

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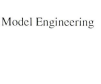

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